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BURDEN APPLICATION**

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COST ACCOUNTING AND BURDEN APPLICATION

BY

CLINTON H. SCOVELL

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INTRODUCTION

The object of this book is to examine the elements of cost, and to define principles and describe methods of procedure in the development of a cost accounting practice, particularly in respect to the determination and application of overhead charges or burden.

In Chapter III material and material costs are discussed with reference to the practice of a machine shop, or similar metal working industry. The principles which govern purchasing, however, and many relating to receiving, storing and issuing materials, are universal in their application.

In Chapter IV on labor costs, the exposition of accounting principles and practice is concerned with work done on definite manufacturing orders (or similar orders for repairs, construction, maintenance, or operating expenses). There are, however, some articles manufactured which for various reasons cannot be conveniently segregated into lots, and their cost of manufacture accumulated on job orders. This is true of some kinds of textiles, the tanning of leather and the manufacture of products by continuous operations, such as flour, brick or cement.

Products like candy, boots and shoes and the cheaper jewelry, although made in well defined lots, cannot effectively have their manufacturing cost reckoned actually in the same units. In the continuous industries the attention must be fixed on processes, and on a unit cost per pound, per square foot, per barrel, per hundred,

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etc.; and on products like candy, shoes, and jewelry, so called "scheduled" costs must be established, and proved by various accounting devices that have been developed by the experience of a wide variety of industries.

The later chapters in this volume, dealing with cost accounting for special industries, have been included to illustrate cost accounting principles on work that is not made strictly by individual manufacturing orders. These chapters should help to make it clear that the principles and much of the practice described in the main exposition, Chapters II to XIII inclusive, can be applied with equal success to other lines of manufacture.

The author realizes with deep regret that there are business men and accountants who will consider that the methods described in these pages are "theoretical" and "complicated," some will say impracticable.

There are two kinds of answers to these objections. The most conclusive is that although all the methods or devices mentioned here are not applicable in any one plant, every one is in successful and effective operation in some progressive industrial establishment.¹

It is a pleasure to add that some of the most "complicated" arrangements, as laymen or inexperienced accountants might view them, have been developed in various industrial establishments, out of the practical necessities of daily work, without much if any advice or direction from professional accountants.²

¹ This is like placing a telephone installation at the disposal of a skeptic who might previously have said: "That is all very pretty in theory, but impracticable."

² The payroll practice referred to in the footnotes on pages 48 and 50, is a good illustration of this. The "balance of stores" system described on page 23 was inaugurated by

If the argument of demonstration is more immediately and more broadly conclusive, it is less fundamental than the argument of analogy. The enduring answer to those who say that anything or any system is "complicated," is that *simplicity is of necessity relative*.

If a thing can be effective *and* simple, all the better; but unless it is effective, it serves no purpose, it does not accomplish results. Locomotives, printing presses, and electrical equipment are indeed complex, but they are result-getters that we never cease to extol as the tools of commerce and civilization. These examples of mechanical achievement are pertinent answers to any objections that may be raised to the methods advocated in this book, because the objections will be for the most part purely mechanical. (This is true even of many of the objections to interest charged to cost—the most theoretical section of the book.)

But still more fundamental arguments of analogy are based on a consideration of the true character of accounts and accounting devices. From the poorly paid bookkeeper's job a science has evolved, just as the trade or craft skill of making iron or dyestuffs has been superseded by the laboratory methods of the technical school. That the author of this book or the reader daily use the electric light does not make us competent technical judges of lamps or transmission devices. We cannot, with our own knowledge, insure ourselves pure and wholesome water, we cannot even test the clothing we buy except by experience. When such analyses are necessary or desirable, we must defer to the chemist and his laboratory.

some of the keenest students of manufacturing efficiency in the country, quite independent of any theoretical consideration.

And the scientific man or specialist, be he chemist or accountant, serves his day and generation, above all, by being practical—by evolving plans that serve the world of business and the daily needs of civilized men. If he does this, the ways and means are not questioned.

Nobody whose opinion deserves respect says that the bacteriological test for pure milk is complicated. If the consumer can get his milk fresh from a healthy cow in a clean stable, with clean containers, no test is necessary. If the proprietor of a little shop works alone, or increases his output by employing an assistant who repeats the same work week after week, he needs only the simplest cost accounting. As civilization and industry become complex, the need arises for chemist, bacteriologist, engineer and accountant—and their well-developed methods.

In comparison with the other three, the accountant is at the disadvantage that men who have learned to defer to the specialized knowledge of the scientist still feel competent to sit in judgment on matters of accounting. But the science in the accountant's methods is coming to be understood and appreciated. Every year sees fewer managers and owners bungling along with rule-of-thumb methods, for it is increasingly plain that those who do not develop adequate accounting for their business undertakings are exposed to constant bother and trouble, and above all *to the risk of loss*.

In offering this volume to the public I take pleasure in acknowledging the assistance of those who lightened the burden of preparing the manuscript, and helped with their criticisms to secure a more complete and more accurate treatment of the various practical and technical matters here discussed.

Mr. H. L. Green, M. E., prepared the preliminary drafts of many chapters, particularly those relating to the development of burden. Mr. F. B. Wolfe and Mr. H. G. Crockett gave help of a similar kind. Mr. W. F. Rockwell collaborated on the chapter on power and steam, and made many suggestions regarding the exposition of production methods. Mr. J. C. Crandell, C. P. A., and my partner, Mr. C. O. Wellington, A. B., C. P. A., have read all of the manuscript, some of it more than once, and have prepared or inspired numerous corrections tending to clearness and completeness.

Here and there in the book it has been necessary to treat of matters that have been the subject of debate among accountants and engineers; for example, in discussing the subject of interest charged to cost I have endeavored not only to make an adequate exposition of the arguments in support of this practice, but also to state and refute the arguments that have appeared in opposition. In considering the opinions of others I have tried to state their views fairly, and for all such controversial passages I assume full responsibility.

It has been difficult amid the exacting demands of other professional work to find time for the complete development of some of the subjects treated in this volume. From the number of suggestions offered by those who have assisted in preparing the text, I assume that many more will occur to the wider circle of readers to whom it is now offered.

I shall be grateful to anyone who will criticize any chapter or section of the book, or point out opportunities for their effective amendment or amplification. This invitation I would extend not only to my fellow accountants, but to the industrial executives and their

assistants whose daily work is to buy, store and issue material, to direct production, and to account for the profits or losses that result therefrom.

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COST ACCOUNTING AND BURDEN APPLICATION

COST ACCOUNTING AND BURDEN APPLICATION

CHAPTER I

THE IMPORTANCE OF SOUND COST ACCOUNTING

A thoroughly dependable cost system which can be used by an executive in forming his manufacturing and selling policies, under all business conditions, is undeniably a great asset. Several influences, moreover, are so affecting industrial conditions at the present time that a dependable cost system becomes almost a necessity.

Influence of Scientific Management

One of the most important of these influences which many managers are experiencing today, is the tendency on the part of their competitors towards the adoption of more scientific methods of management. Just so far as these modern types of management are adopted and become an established success, those who do not adopt them will

COST ACCOUNTING

gradually fall out of the running. On the other hand, managers hesitate to pay too dearly for new methods only to find that they are not a success. The true measure by which to judge is the relative unit cost of production attainable under their existing methods of management as compared with unit costs attainable under a more scientific management. **This comparison can only be made when every factor of expense has been intelligently taken into the reckoning.**

One of the main objects of scientific management is to reduce unit labor costs by increasing production. It is necessary and equitable that a part of the savings be paid back to employees as a reward for their efforts. It is also necessary that the organization be built up (usually by establishing what is known as the planning department), to carry out the routine work in connection with the operation of this form of management, and the cost of this organization must be met out of the savings before the net profit to the company can be determined.

The fact that an industrial plant has a planning department costing \$75,000 annually means nothing from the point of view of ultimate results. Similarly, the fact that the introduction of scientific management in a plant increased production

20 per cent means nothing definite in itself. The wisdom of adding a planning department to existing methods of management can only be known when all of the elements of cost have been taken into consideration and reduced to a comparative basis.

Organization of Labor

Another factor which is bound to affect costs, and through them industrial conditions in general, is the rapidly increasing organization of labor, and the demand for a shorter day with equal or increased wages. As increasing costs are ultimately passed on to the consumers—chiefly workmen—the net result is temporary relief, only during the period of price adjustment, and for those who first secure an advanced wage. The success of organized labor in this direction will not give any lasting benefit to the workmen, unless the increase in cost of production resulting from higher wages is offset by other influences, such as a more careful study of the science of management, aided by dependable cost records, tending toward increased economies in production.

A type of management which can successfully increase wages and reduce unit costs in industrial plants will be of double benefit, because not only

will wages be increased, but the purchasing power of money will be increased also.¹

Unintelligent Competition

Whenever two or more manufacturers of the same product attempt a discussion of their costs, they almost invariably find that the cost accounting methods in their respective establishments are not enough alike to admit of any conclusive comparison. If piece work prevails in the industry, or if operations are very clearly defined, they may make a fairly useful comparison of labor costs; and they frequently satisfy themselves with the assumption that they buy their materials in the same market and more or less at the same prices.

There is usually no agreement whatever as to the classification of overhead charges or burden, or what is of more consequence, how this most important element of cost should be applied to the product. Even those establishments that

¹ This is exactly what has happened recently, and at a very rapid rate, in the production of automobiles; and in former years, and with not such spectacular rapidity, in the manufacture of sewing machines, harvesting machinery, typesetting machines and other labor-saving devices. Wages of the skilled workers who build machinery of this kind have been constantly on the increase, and the price of these articles to the consumer has also decreased.

have made some effort to develop an accounting practice are handling their cost charges in such diverse ways that they suspect each other of selling goods at less than cost; or not having any proof that their own cost system is dependable, they argue that if another manufacturer can afford to sell an article at a given price, they also can afford to make it and sell it at the same price. All too frequently men will reason in this way in regard to competitors, without realizing that these competing plants may have no adequate cost methods, so that not even the owners themselves know whether they can afford to sell the article in question at the price that is named.

The investigations of the Federal Trade Commission have brought to public notice the widespread lack of adequate accounting in American business establishments, both trading and manufacturing. The commission says: "A large proportion of manufacturers are not making the money they should; a great number are actually losing money," and draws the conclusion that these unsatisfactory results are due in a large measure to the lack of adequate information in regard to the conduct of the business.

One of the best passages in the pamphlet publication of the commission entitled "Fundamen-

tals of a Cost System for Manufacturers" is that in which they explode the idea, which so many manufacturers have, that their business is unique or "different," as the professional accountant so frequently hears it said, so that no system could be devised which would give true costs. Any experienced accountant would heartily concur with the statement that "it is unquestionably true that some lines of manufacture lend themselves more readily to the installation of a cost system than others, but it is also true that no line of manufacture is so complicated that a system cannot be devised which will give reasonably accurate results."

The commission does a good service to the American manufacturer by insisting that "an accurate determination of cost is fundamentally related to manufacturing efficiency," that a *cost system is an investment* fully justifying the expense of installation, and that the cost of operating an adequate system is frequently no greater than that of running the slipshod methods which are superseded.

Many manufacturers dread a development of their cost and accounting practice for fear that their business will be swamped with a multitude of printed cards and ruled sheets, and formal-

ties frequently referred to as "red tape." What these manufacturers do not realize is their undefined, but nevertheless ever-present loss from insufficient knowledge of their costs, and the unwise business policies based thereon.

Cutting Costs to Save Profits

The cycle of manufacturing operations starts with money, which is used to purchase the material and labor and to defray the overhead expenses necessary to manufacture the desired product. The manufactured product, when sold, is exchanged for money again. The success or failure of a business enterprise depends upon its ability to make the income from sales show a satisfactory margin over the outlay required to manufacture the goods sold.

It is apparent that the margin between sales and cost of goods sold, which in most lines of industry tends to grow narrower year by year, can be increased in two ways—increasing the selling price, or decreasing the cost.

The market for a particular product may be such that selling prices and profits can be increased without inviting additional competition. In many instances, however, a selling price is fixed by market conditions so that a profit cannot be

made by increasing selling prices, but rather a profit must be *saved* by decreasing manufacturing and selling costs.

The saving of profits is aided by an adequate cost accounting practice which will help determine what to make, in what quantities it should be made, how much it should cost, and what it can be sold for. It is not sufficient that this be known for a business as a whole, for some products may be made at a profit and others at a loss. The cost accounting practice, therefore, must analyze the net results of manufacturing, to show the gains or losses on each line of product.

It is even more important to the average manufacturer to analyze the elements of his costs, especially overhead expenses or burden, to learn the relative importance of different items, which ones are practically fixed, and what will carry the variable items up and down, actually and relatively. If he wishes to control expenses he must make an intelligent forecast, and know whether the results, from month to month, are within the limits he has set.

The development of an adequate cost accounting practice in an industry where processes and the course of manufacture are at all complicated re-

quires intelligent, painstaking analysis. There must be a careful observance of principles and a selection of plans or methods that will make it possible to carry the principles into effective operation. The days of the "rule of thumb" are gone forever in an industry that has any active competition, and the economy of manufacture and management, which brings profits to the owners, is to be secured only by a painstaking examination of details. There must be a careful regard for the costs of alternative methods of manufacture as well as their effectiveness.

Precision is the watchword of science, and the test of accuracy will appear again and again as a paramount consideration in deciding what method shall be followed, or how far details shall be developed, in planning a cost system.

CHAPTER II

ELEMENTS OF COST

All manufacturing costs are made up of the three elements: Material, Labor and Burden. No product, however simple or complex the processes required in its manufacture, can be made without incurring the cost of these elements. For example, in the manufacture of a simple part, requiring one or two machining operations on a rough casting, the value of the casting is the material cost, and the pay of the mechanic who performs the machining operations is the laborelement. Burden is made up of rent, for the space used by the machine tools required, interest, taxes, insurance and depreciation on the investment in the machinery, and such operating charges as repairs, power, supplies, supervision, etc.

At the outset it may be well to dispose once for all of two matters that bother some readers of accounting topics. One is the misconception that burden and overhead are different things. They are merely different terms for the same thing, namely, everything in a manufacturing plant that

is not direct labor, direct material, or selling expense.

Then there is the fallacy that "costs" are labor and material only, and that everything else is overhead, or "the cost of doing business, after the product is made." It will probably seem absurd to most readers that anyone could hold such an opinion that it needs refutation here, but sad to say, there are a few people who think as loosely as that about industrial accounting. The author has just encountered in the writings of a very well known American engineer, almost the identical phraseology quoted above. Burden, let it be clearly understood by the readers of this volume, is *an element of cost* and not something extraneous.¹

The Production Plan

The manner in which manufacturing costs are

¹ It has been suggested by men interested in the relations between capital and labor that both "burden" and "overhead" are unfortunate terms for the capital or management costs of a business. It is claimed that they suggest to untrained men who are emphasizing the significance of the laborers' contribution to production that labor is "burdened" with improper charges for which it is not responsible. Anyone who understands the function of capital and management in production of course recognizes the error of this view, but if a better term can be suggested it should be welcomed.

accumulated may perhaps best be illustrated by a consideration of the routine connected with the issue and execution of a manufacturing order, for cost accounting and production methods are very closely related to each other in a progressive shop or factory. The exact steps will vary with each individual plant, but the illustration given is typical of the procedure in an up-to-date machine shop. The routine is much the same in any metal working establishment.

Assume that a customer has placed an order for a lot of machines which cannot be supplied immediately from stock. The first point to consider is the relation of this new order to the production schedule or manufacturing program of the business, if one has been established. It may be that the new order requires only an allotment from a number of similar machines already under way. Or the new order may be large enough, or sufficiently different in character from other work in the shop, to change the entire program of manufacturing operations. If this is the case there are many important details of shop practice to consider.

The way to plan the manufacture of finished machines is to plan the manufacture of the parts from which the machines are assembled. The assembly

problem can be greatly simplified on large or complex machines by first reducing it to terms of groups or subassemblies. For each one of these assembly groups, or for the entire machine, if it is a simple affair, there should be a complete bill of materials showing a list of parts and the quantity of each required. This bill of materials is turned over to the clerk in charge of a finished parts stock record, who determines which parts are on hand and which must be made. If all of the necessary parts are in stock, an assembly order can be issued and the assembly group or complete machine finished at once. On the other hand, certain parts may not be available, and it becomes necessary to order stock from the raw stores department, and to have it machined before delivery to the finished parts stock room or assembly floor.

In this case reference is made to a raw stores record to find out whether or not the necessary raw materials are on hand. If they are, the planning department can at once issue manufacturing orders to have the parts issued from stores, machined and delivered to finished stock. It may be found that certain necessary castings are out of stock and must be ordered from the foundry, or, if the plant has no foundry, purchase orders must be placed.

Following this general procedure, with variations ¹ suited to the needs of individual plants, the materials are provided necessary to make all of the finished parts, which, when assembled, make up the machines called for by the production order.

After the necessary raw materials are in stock, production is started on the individual shop orders by requisitioning the required amount of material and delivering it to the machine performing the first operation. Through this and subsequent operations costs are collected until the finished parts are ready for delivery to the assembly floor. These parts may be passed through a finished parts stock room, being requisitioned as needed and charged to subsequent assembling order numbers.

Material Cost

The requisitions for raw material are priced and extended to give the cost of the materials withdrawn from stores. This amount is charged to the cost of the order for manufacturing the parts, and thus ultimately to the cost of the assembled machines. Requisitions for raw materials are usu-

¹ Drop forgings, metal stampings and such products as drills, chisels, and other small tools are obviously made direct from raw materials; there is no assembly feature in their manufacture.

ally priced at an advance over corresponding invoice prices, to allow for the cost of purchasing, receiving, and storing the raw materials previous to their delivery to the shop.¹

Labor Cost

There will be a varying number of operations to be performed on each one of the machine parts. Labor tickets are made out for each of these operations, and from the piece rates, or the elapsed time for the operations shown on these tickets multiplied by the rates of pay of the employees performing the operations, the labor cost of each is calculated. A summary of labor costs by operations on each part, gives the total labor cost for that part.

Burden Cost

During the time that labor is employed in the manufacture of the parts, the equipment necessary to perform the operations is being used. For each kind of equipment the management incurs varying expense for rent of space occupied, interest on investment, taxes, insurance, depreciation, repairs, power, supervision, supplies, etc. If a careful distribution of burden charges is made, this expense will be determined for each production center, or

¹ See pages 34-38.

for each class of machines or each department, and expressed as a burden cost per hour. Burden will then be charged to the cost of each operation, depending on the time required to perform that operation, at the hourly rate for the use of the equipment in question.

Manufacturing Cost

Following the general practice described above, material, labor, and burden charges will be made against each part. A summary of these charges gives the complete manufacturing cost of the finished part, which may be carried in stock for a time and subsequently requisitioned when an order to assemble is given.

In addition to the finished parts which may be made at the plant and carried in stock, other parts may be purchased ready for assembling. Such purchased parts will be requisitioned with the manufactured parts, and are usually priced at an advance over corresponding invoice prices to cover handling and storage charges, as referred to in the discussion of material costs.¹

The manufacturing cost of a finished machine is thus the sum of the cost of the finished parts, plus the labor and burden charges for assembling.

¹ See page 34.

In some instances there may be special charges, such as royalties, which are properly a part of manufacturing cost.

Selling Price

A selling price should be the sum of manufacturing cost, selling expense, allowances for undistributed burden charges, and the desired net profit, properly determined for the product in question. In practice, competition, general trade conditions, or other influences may call for quotations either over or under this price, as a matter of policy.

The preceding paragraphs have outlined the routine of accumulating material, labor and burden charges resulting in the determination of a manufacturing cost. These will be discussed in detail in the succeeding chapters.

Of the other elements which must be added to a manufacturing cost to determine a selling price, the true significance of unearned burden should be clearly understood. In the past it has been common practice to charge all burden to the product made, regardless of the volume of production. The better method, explained fully in Chapter XII on Unearned Burden, is to keep out of manufacturing costs, the expense or burden of unused facilities for manufacturing and to charge it to the

Loss and Gain account ¹ at the end of each operating period (month or four weeks).

A selling price, necessary to yield a desired net profit is determined, therefore, by adding manufacturing cost, selling expense, and a gross profit, the latter being sufficient to absorb the average losses due to unearned burden (unused capacity for manufacturing) over a long period, and leave the desired net profit.

¹ See pages 184-187.

CHAPTER III

MATERIAL AND MATERIAL COSTS

To provide for the purchase of material, its proper care when received, its delivery to the manufacturing departments, and the accumulation of material costs, certain routine steps are necessary.

Routine of Handling Material

All materials should be ordered through the purchasing department by means of a written purchase order. A receiving system should provide for a check on the quantity and quality of materials received and a definite record of this checking. Materials, when received, should be transferred to the stores department, and the quantities entered on a stores ledger. This necessitates the development of a method for storing materials properly, recording receipts, disbursements and balances on hand, to insure that materials will be available and in condition for use when wanted.¹

¹ It should be understood throughout the book, and particularly in this chapter, that it is not to be expected that every plant will have all the organization referred to. The attention of the reader should be fixed on functions. For example, if

As noted in Chapter II, there are usually two distinct steps in the manufacture of a machine, or almost any metal product; first, the manufacture of finished parts, which are delivered to a finished parts stock room; and, second, the assembly of a finished machine, the necessary finished parts being requisitioned from the stock room and charged to the assembling order number. Thus it is necessary to provide a stores department and a Material account in the ledger for finished parts as well as for raw materials. Depending altogether on local manufacturing conditions, these two departments may or may not be physically in the same room and under the supervision of the same stores department head.

Stores should be withdrawn from stock on material requisitions, which should be so designed as to give the necessary data for detailed credits in the stores department for the *quantity* of materials withdrawn; and the information regarding price necessary for a credit to the Raw Material account for the *value* of the materials withdrawn, and a corresponding charge to the order numbers on which materials are used.

all receiving work is done and stores records made under the direction of one man, it may be possible to omit some of the forms, or use fewer copies.

Proper methods for ordering, receiving, storing and issuing materials, following the general routine indicated above, must be provided to insure accurate material charges.

Maximum and Minimum Limits

One of the important details in a well-developed stores system for either raw material or finished parts, is the determination *and use* of a system of maximum and minimum limits.

The maximum and minimum amount of each item which it is desired to have on hand should be known by the stores clerk. This information is sometimes noted on the bins or spaces where materials are stored, and in any event it should appear on the stores ledger. The minimum limit should be high enough so that there will not be any danger of running out of material, and consequently delaying manufacturing operations until a purchase or manufacturing order can be filled, and the maximum limit should be as much above the minimum as it is economical to buy or make at one time.

The determination of the maximum, and the economical quantity for an order, depends directly on the quantity the establishment uses in manufacturing orders, or sells as repair parts, and the

cost of carrying a larger rather than a smaller stock. If the article is purchased it is necessary to consider also prices, available supplies, the time required for delivery, and other market conditions; and if the article is manufactured in the shop, the time and cost to set-up and manufacture, and the probable proportion of defective pieces in an order.

In most establishments, the quantity to order will be largely influenced by immediate requirements of the manufacturing schedule, which, in turn, is influenced directly by customers' orders or manufacturing orders for stocks. In such cases, what "is economical to buy or make at one time" will not be uniformly the same. It must always be determined by reference to immediate needs, and the most that can be fixed is the maximum to be added **above the immediate requirements**. The maximum, moreover, is something to be determined by experience, and that establishment is fortunate in which the stores clerk knows how to exercise effective discretion on all variables, or has such relations with his superiors in the organization that the orders get the desirable elasticity that means economy and efficiency in the long run.

It is only when the stores system is highly or-

ganized, and precise and dependable information is available regarding quantities used, that hard and fast rules can be established regarding maximum and minimum stocks, and quantities to order can be set and followed without such variations or discretion.

It should be one of the duties of the stores clerk to compare the available balance of materials with the minimum limit and notify the purchasing department by means of a purchase requisition when this balance for any item of purchased material falls below the established minimum.

Purchase Orders

A purchase requisition is a request to the purchasing agent to order certain raw materials. In a shop with a well-organized raw material stores system the purchase requisition usually comes from the stores ledger clerk, when the *available balance*¹ of these materials has fallen to the minimum limit.

Material should be ordered by the purchasing department with a written purchase order. The number of copies made of a purchase order, and the way they are used, depends greatly on the per-

¹ For a technical definition of "available balance" see page 30.

fection of the organization respecting purchasing, stores records, and the production system. If there is a highly perfected stock control, as described in the preceding paragraphs, the stores ledger clerk not only initiates many purchase orders by purchase requisitions, but he must have prompt information about purchase orders placed, as they are one of the important factors in determining the available balance.

In a scheme of that kind a purchase order should be written in triplicate at least. The original goes to the vendor to whom the order is given. The second copy is placed in an unfilled order file in the purchasing department, preferably arranged alphabetically by vendors, with an adequate "signal" or tickler system, so that a check can be kept on the delivery of the order, and an inquiry started in case the delivery has not been made by the proper date. The third copy should serve as advice to the receiving department. A short carbon may be used in making this copy so that the items which have been ordered appear, but the quantities and prices do not.

When a copy of the purchase order is furnished to the receiving department, it should remain on file there until the goods are received, when the quantities received are entered opposite each kind

of material, and the copy is returned to the purchasing department. When the stores ledger practice includes a record of goods "on order," the copy of the purchase order intended for the receiving clerk must go to him by way of the stores ledger, unless an additional copy is made for the ledger clerk.

Receiving Methods

That the receiving department should be advised as to the vendor's name and the kind, but *not the quantity*, of purchases to be received was a generally accepted opinion as to good receiving methods only a few years ago. When analyzed, this view is seen to be based on the idea that the purchasing department should have an independent report of the count, measure, or weight of articles received, or that someone in authority over disbursements should have a receiving record on which to voucher payments independently of the purchasing department.

It would perhaps be too much to say that this idea has been, or that it should be, generally abandoned, but the author inclines to that opinion. It seems evident that a loyal, honest storekeeper can serve his employers so much more effectively when he knows exactly what is on the way, and

that the identification of incoming materials is so needlessly hampered by "blind checking" as to fully offset any theoretical advantage which it may seem to have. This view, at all events, is supported by the present practice of some very progressive, alert managers. It is, furthermore, confirmed by the experience of railroad employees unloading and transferring less-than-carload freight.

Whether the copy of the purchase requisition that goes to the receiving department should show prices, as well as quantities, depends entirely on the relation of the receiving force to the stores ledgers. The stores ledgers can be operated showing quantities only, but that implies pricing requisitions from an independent price record of some sort. This is usually a needless duplication of work.¹

As partial shipments may be received, it is frequently desirable to have an independent receiving record, possibly using the copy of the purchase order to indicate the receipt of the shipment which finally completes the purchase order.

A good plan is to provide a receiving book with pages in duplicate and numbered serially. Space should be provided for recording the quantities

¹ See page 41.

and description of materials received, the name of the shipper, references to the freight bill and the amount of freight or express charges paid in transportation, and the invoice price of the goods. The two latter items, freight and invoice price, are added in the purchasing department, or by the accounting department, the receiving department simply noting the shipper and the quantity and description of materials received.

This method, with the pages numbered serially, assures the purchasing department that all receiving slips have been accounted for. With the original copies perforated, they may be sent to the purchasing department, leaving in the receiving book the duplicate copies as a permanent bound record of all receipts. As soon as all the pages in a receiving book have been used, the bound copy of the duplicate receiving slips should be filed by the purchasing department. This complete file of receiving records may be held for such a length of time as may be desirable.

Purchase Invoices

The handling of purchase invoices is an accounting detail with an important administrative aspect, for the person who takes responsibility for payment must know that the goods have been re-

ceived as billed, and that freights and discounts are handled properly.

Freight bills should be considered in connection with every invoice on which incoming freight or express charges are paid. If the freight is to be charged back to the shipper, the amount of the freight bill will be deducted in settlement. If the purchaser is to stand the freight, the amount of the freight bill will be added to the amount of the invoice, and distributed with it as a charge to the material accounts, and ultimately (by the increased unit cost) to manufacturing orders on which the material is used. In either case freight bills must be identified with the receiving record and the invoices.

When it is feasible to deduct the allowable purchase discount from the face of the invoice and distribute the remainder net, that should be done, as purchase discounts are in effect a diminution of the purchase price. Purchase discounts which cannot be conveniently or justly handled in that way may be credited to the Store Room Expense as explained on page 36.

As purchase discounts are very frequently wrongly regarded as an income of the business, and so incorrectly omitted from cost accounting calculations, it may be well to point out that the

real cost of any purchase is the net cash cost. Most business men will agree unquestionably that it is bad management to miss purchase discounts, and there are some lines of business in which one cannot expect to prosper, or perhaps even keep going, unless discounts are taken regularly. If purchase discounts are deducted from the face of invoices, it is easy enough to bring out the loss from neglected discounts, and this is certainly much more significant as an index of management than to consider purchase discounts as income.

The receiving record and the net unit price (plus freight, if paid; and minus discount, if any) must be reported to the stores ledger clerk in some convenient manner. This may be done by letting him use the invoice temporarily, or better the receiving report, because more promptly available.¹ The principle is clear; the actual working plan in any case will depend on many details of administration and organization.

The Stores Ledger

The stores ledger should either be on cards or in a loose leaf binder, whichever seems most desirable. There should be a card or page for each kind of material, and proper spaces provided to

¹ See footnote page 44.

show the name of the material, its symbol, size, location in the stores department, and the maximum and minimum quantity which it is decided to carry in stock. This information usually appears at the top of the stores ledger. The body of the ledger is ruled to provide columns for entering the date and quantity of raw materials ordered, received, reserved on production orders, issued on requisitions, and the balance available and on hand at any given time.

In some instances where jobs are planned considerably in advance of the performance of the work, the raw materials necessary for an order may be reserved by an entry on the stores ledger previous to the time when the material is actually requisitioned from the stores department. In this event the ledger card or page will show, in addition to the balance of material on hand, the balance which is available for production orders not yet started. The available balance is the quantity actually on hand as an inventory plus the quantity on order (through the purchasing department), less the amount reserved for jobs which have been planned but not started.

To keep this plan in operation assures the manufacturing department against unexpected shortages of material, balances purchases better, and

enables the plant to operate with a minimum of investment in inventory. A perpetual inventory of material is essential to the most successful operation of a cost accounting practice, and is of value not only to secure accurate costs, but used in this way, it helps to secure efficient management as well.

One of the first purposes of the stock ledger is to insure the control and conservation of material. The cash account is debited with all money received and credited with all money paid out. The book balance can be determined at any time, and this balance is subject to verification, thus insuring the honesty and accuracy with which this asset is handled. There is no difference in theory between handling cash and material, and less difference in the real merits of the two than most people realize. The Raw Material account, appropriately subdivided, is debited with the cost of all purchases and credited with the cost of materials requisitioned, which are in turn charged to the cost of work-in-process. The balance in the Material account can be determined at any time by an inventory taken from the stock ledger, or by a physical inventory, properly extended, just as the book balance in the Cash account can be verified by counting the cash. Raw material is the equivalent

of cash, and it is just as important that a close control be kept over this asset.

A well-kept stores ledger provides an effective control over the amount of capital which is tied up in inventories, and the net balance of each class of raw materials is under much closer supervision than would be the case if it were necessary to ascertain the balance by taking a physical inventory. As the stock ledger furnishes a dependable total inventory without necessitating the taking of an actual physical inventory, a loss and gain statement can be taken from the books at the end of each month or four weeks' period.

It is obviously important to have these inventory balances as accurate as possible. The *quantity* on each article is important as an administrative matter, and the corresponding value of the total is equally important as a matter of finances. If the book value is improperly marked down by excess credits, the assets of the company are under-stated, and the cost of current manufacture over-stated; and vice versa, if the book value of stores inventory is too large because of insufficient credits.

The balances appearing on the stock ledger should be verified at occasional intervals to insure that the record is accurate. This can best be done

by verifying the inventory of a few items daily, so that in the course of a reasonable length of time the entire inventory will have been verified. It is an excellent plan systematically to verify minimum quantities whenever they are reported in connection with a purchase requisition. This involves a comparison of ledger balances with the quantity on hand. If bin cards are used they should come to the office for comparison at such times. Bin cards should also come to the office for comparison whenever a bin card is filled with entries and replaced by a new one.

The Stores Department

The stores department should be conveniently located, so as to facilitate the receipt and issue of materials. Bins, racks and floor space should be provided in the stores department for storing each kind of raw material to advantage. It may not be advisable to keep all stores in one place, and this is not at all necessary. For example, pig iron and heavy castings may be stored in the yards where crane service and transportation facilities are available. Foundry materials, such as sand, coke, etc., are usually stored in a separate building, especially designed to facilitate the unloading of cars and subsequent delivery of the material to

the molding or charging floors. Lumber and large castings are usually stored at advantageous points in the yard. All small castings, nuts, screws, etc., are preferably stored in bins at some convenient point in the shop itself. Bar stock is usually carried in racks. The important consideration is to have all stores come under the supervision of the stores department, so that no material can be taken without a proper requisition.

Stores Expense

A cost of material for a manufactured product that should not be overlooked is that incurred for its purchase, storage, and issue. This includes salaries and expenses of purchasing agents and clerks, wages of storekeepers, stationery and other supplies for their use, rent for storeroom spaces, and fixed charges (taxes, insurance, interest) on the value of the stock, as subsequently described in Chapters VI to IX, inclusive.

On some kinds of material there is a decided loss through breakage or spoilage, or a difficulty of getting exact weights or measures on account of variable moisture content, or the expense of providing or using adequate weighing or measuring devices. There will be some breakage on glassware in handling, liquids are spilled or evaporate,

cloth must be shrunk before it is used for accurately fitting garments, wood pulp or rags gain or lose moisture according to the conditions under which they are stored. For all these circumstances something must be added to the invoice price if the material accounts are not to show a shortage at inventory time.

Inward freights should be added and purchase discounts should be deducted from the invoice price of raw material. It is simple enough to do this on all important purchases, if orders are given and plans are made accordingly. It will be generally admitted that a calculation of inward freights as part of the purchase price is indispensable to a manufacturer who wants to compare prices on material bought from several sources of supply f.o.b. shipping point.

Purchase discounts, on the contrary, are quite generally wrongly ignored in reckoning material costs and inventory valuations. It must be quite apparent that purchased material is not worth more than its cost to use or to carry in inventory. This is obviously the net price if cash discount is taken. It seems to be equally apparent that one lot of purchased material is not worth less, and the next lot more, solely because purchase discount is taken on the first lot and neglected on the second

lot, or worth less to one manufacturer because he takes the discount, and more to his competitor because he neglects his discounts.

This seems to lead to the unqualified conclusion that purchase discounts are properly a deduction from invoice price, and it is easy enough to do this when it amounts to anything. It is hardly worth while on miscellaneous small purchases, especially on goods bought delivered, on which there is no price adjustment to be reckoned at the same time for freight; or where the company's purchases are predominantly of one kind, and at a uniform rate of discount.

Unless inward freight is added to individual invoice prices, it is properly a charge to raw material stores expense, and if purchase discount is not deducted from individual invoice prices, it is properly a credit to raw material ¹ stores expense.

Cases have been known to the author where heavy cash discounts on uniform purchases handled as here suggested, have served to equalize all other stores expenses.

Not infrequently a manufacturing plant will use heavy, bulky stores like lumber or pig iron, or special castings that come direct to the shop

¹ Neither of these items is related to stores expense on manufactured parts or finished goods.

(and incur no storeroom handling charges), or articles of special value, like electrical accessories. It may be wise to make a special rule in regard to stores expense in such cases, but such exceptions (like a rate per M feet in lumber) must be considered on their merits in individual instances.

Of the exceptions noted in the paragraph above that in regard to material of special value is likely to be the most important, for the reason that a percentage on value is the most convenient way to apply a stores burden rate. Even in a plant that is manufacturing a product that uses material of widely varying values the cost of the total will not be distorted by applying a uniform rate on all stores issued if the exceptional values are used in all the product in about equal proportion. If parts of widely different material value are sold separately, or if the various products of the plant are made of material of varying value, bronze and gray iron, for example, it is essential that the stores expense rates be so determined that the total cost will be applied equitably to the different materials issued.

The same general kinds of charges belong to manufactured finished parts except purchasing, inward freight, and purchase discounts. That is, a store of finished parts will use space, for which

rent should be charged, fixed charges (interest, taxes and insurance) will be incurred on the value of its inventory, and there will be a clerical or storeroom force to handle the work. In some plants, especially where a large staff must be carried to issue complex parts requisitions, the rate for stores expense may be higher on finished parts than on raw material.

Mnemonic Symbols

The use of a mnemonic symbol assigned to each kind of stores reduces the amount of writing necessary in making out requisitions and stock records, and may also be made to serve as an index to locate stores when they are arranged in the stores department in accordance with their symbols.

There are some cases where the mnemonic classification and storing of materials can be used to advantage, but to carry out the mnemonic idea in a large plant handling a variety of stores, frequently involves the use of symbols containing so many letters that the system ceases to be truly mnemonic, and consequently loses much of its potential value. In such cases it takes longer to verify the meaning of a symbol which cannot be remembered than it would have taken to write out

the complete name of the article in the first place. This applies to all the people who have to read the symbol.

There are, moreover, some difficulties about attempting to arrange materials in the stores department in accordance with their mnemonic symbols. It is frequently much more satisfactory to designate the bins, racks and sections of floor space by some numerical scheme, and have these locations appear on the stores ledger. This plan is more flexible, facilitates an arrangement of the stores to insure convenience in handling, and allows for the expansion of the stores department.

Stores Requisitions

All materials should be withdrawn from the stores department by requisitions made out preferably by the proper clerk in the planning department. A requisition should show the kind and quantity of material wanted, the department to which the material is to be delivered, and the job order or expense account number which is to be charged. It should provide for a signature to acknowledge the receipt of the material, and in some cases for an approval of the requisition before it is presented to the stores department. Space should also be provided so that after a requisition

has been filled, the stores ledger clerk can enter the unit material prices¹ and calculate the cost of the material issued.

In the event of material being returned to the stores department, a credit requisition should be issued, indicating the quantity and value of the material returned, and the order number which is to be credited.

In some cases, particularly where finished parts are requisitioned from a finished parts stock room, group requisitions may be used. These requisitions may well be blue-printed from a standard tracing. A group requisition is an aid to accuracy and saves clerical labor. The tracing is made so that the print will show a complete list of the finished parts making up an assembly group or complete machine, while white spaces are left on the print so that the assembly order number and the quantity of parts necessary to assemble the desired number of finished machines may be filled in. While the list of parts per machine is a standard as shown on the print, the quantity requisitioned will vary in proportion to the number of machines to be assembled on each order.²

¹ See comments, pages 26 and 41.

² This idea of a group requisition or bill of material is subject to a wide variety of applications, generally contributing

Pricing Material Issues

How material issues are priced depends on how the stores ledger is kept. With rare exceptions, the best practice is to have the price recorded on the stores card, so that when a material requisition goes to the stores ledger to have the withdrawal of the material entered, it can be priced at the same time. (The reader should understand that this does not imply that the stores ledger is kept in values as well as quantities. The information as to unit prices may be used to price the stores inventory annually or semi-annually, just as it is used to price the requisitions, and a balance of the stores value will appear on the individual stores ledger cards or pages at that time only.)

Material issues are frequently priced from a separate price record. The use of a separate price record is open to the objection mentioned on page 26. It is open to the further and sometimes very important objection that, if materials are being bought at frequent intervals, and the price clerk is using the latest price, he may be pricing materials out of stores at a higher cost than purchase prices on a rising material market, and at a lower cost than purchase prices on a falling market to accuracy and order in handling materials as well as marked economy in record making.

terial market. To state this very practical problem another way, a lot purchased earlier at a low price may not have been entirely issued before a new lot is purchased at a higher price, and the new price wrongly used on the requisitions, while on a falling market the earlier purchase at high cost may not be all issued before the price clerk notes and uses a new and lower price.

On a rising market there will be a tendency to overprice issues, resulting in an excess charge to manufacturing cost, and an excess credit to stores, thus understating the book value of the remaining stores inventory; the adjustment necessary at an actual stock taking will then be a profit, slowly accumulated at this point in the company's operations by overpricing materials issued and charged to Work-in-Process. On a falling market there will be a tendency to under-price issues, resulting in an insufficient charge to manufacturing cost and an insufficient credit to stores, thus overstating the book value of the remaining stores inventory; the adjustment necessary at an actual stock taking will then be a loss.

Summarizing Material Costs

It is customary to have a cost card for each manufacturing order in process, to which mate-

rial requisitions are posted after being priced from the stock ledgers and extended. Labor and burden charges are also posted to the cost cards, in accordance with the methods which will be explained in Chapter IV. Sometimes the desired results may be better secured by filing material requisitions and labor tickets, pending the completion of the order, instead of posting in detail.

Summarizing the material, labor and burden charges on all the cost cards at the end of a cost period, or if filed and not posted, summarizing the tickets and requisitions daily or weekly as explained in the next chapter,¹ gives the total material, labor and burden charges which are a debit to the cost of Work-in-Process. The amount of material in process as shown by the balance of the account by that name (as a subdivision of Work-in-Process) is supported by the material charges, which are either posted to the cost cards, or in the file as material requisitions on unfinished manufacturing orders.

There are so many points to consider in handling materials and material costs that a brief summary of the chapter may help the reader to have the outline clearly in mind.

The raw materials necessary for manufacturing

¹ See page 54.

are ordered by the purchasing department aided by purchase requisitions from the stores clerk, who has a close supervision over the quantities on hand. A proper receiving record is made, preferably in duplicate, for all material received, one copy being sent to the purchasing department for comparison with the purchase order, and on the way or subsequently to the stores department for entering the quantities received on the stores ledger.¹ Raw materials are withdrawn from stores by means of requisitions, sometimes in the form of a bill of material, and the quantities withdrawn are credited on the stores ledger, which shows at all times the quantity of raw materials on hand.

The raw materials requisitioned from stores become work-in-process, and on completion are delivered to a store room for finished parts or completed machines. They are then entered on a stores ledger for finished parts similar to the raw stores ledger. When an order to assemble is given, the finished parts are withdrawn from stock by means of group requisitions, and after the assembling operations are completed, finished ma-

¹ Unless the receiving record goes first to the stores ledger clerk, the purchasing department must act promptly, for it is essential that the stores department know as soon as possible what is on hand.

chines are delivered to stock. Special work may also be done on an assembly order.

This completes the routine of keeping track of the quantities of materials used, from the time they are purchased until finished machines are delivered. Parallel with this routine, which records the *quantities* of material in each stage from raw material to finished product, corresponding cost accounts are debited and credited to show the *value* of the materials in each stage. For example, the Raw Material account, appropriately subdivided in case it is desired to keep raw material inventories by classes, is debited with all purchases of raw material. The requisitions on which materials are withdrawn from stores are priced, extended and summarized by classes of materials. These totals serve as a credit to the Raw Material accounts and a debit to Work-in-Process. Just as the stores ledger shows the *quantity* of raw material on hand, the balance in the general ledger accounts for classes of raw materials will show the *value* of the material on hand.

The material value of Work-in-Process, shown in total on the ledger, is supported by the material charges on the cost cards, or in the file of material requisitions, corresponding to the order numbers for Work-in-Process. At the end of each cost pe-

riod, the cost cards, or detailed labor and material tickets, for those order numbers which have been completed during the period are summarized to give total material, labor and burden credits to the Work-in-Process account and debits to the Finished Parts Inventory.

The group requisitions which serve to withdraw finished parts from stock are also priced, extended and summarized at the end of each period, and serve as a basis for crediting the Finished Parts Inventory account and debiting the account or accounts for complete machines in process. Thus, parallel with the manner in which the *quantities* of material in each stage of manufacturing are known, the *value* of the material in each stage is also known by means of debits and credits to the material accounts.

CHAPTER IV

LABOR COST

Importance of Labor Records

It is almost unnecessary to say that in order to have accurate manufacturing costs, the labor element of cost must be carefully determined. A proper distribution must be made to manufacturing orders for the labor cost of the product, and to special plant or repair orders, or to standing orders, for the expense of labor not directly engaged in production. As labor is an important element of cost in nearly all industries, and the labor reports supply the information necessary for a burden distribution, it is highly important that they be made as accurately as possible. Otherwise incorrect labor and burden charges are bound to result, and the total manufacturing costs will be misleading.

There are usually two original labor records, the weekly clock cards, which are commonly used to record the time employees enter and leave the factory, and the work tickets, or job cards, which are used to give a distribution of employees' time

to order numbers. Each of these sources of information has a particular purpose, and together they provide the necessary data, when properly summarized, to give correct labor costs.

Clock Cards

The primary purpose of the clock card is to record the total amount of time worked during the week or pay period by each employee, and thus serve as the basis for computing the payroll.

A clock card should show the employee's name, number, the department in which he works, and the dates.

At the end of each pay period the clock cards are collected from the rack where they are kept in the shop and sent to the payroll department. Here the total time worked by each employee is summarized and the wages due day workers calculated. From this information the payroll and pay envelopes are made up.¹

Job Cards

The second source of information relative to labor cost is secured from the work tickets or

¹ One highly organized factory is known to the author where cost accounting is done in great detail, and a payroll carefully proved with work tickets or job cards, without using any attendance cards whatsoever.

job cards, which show the amount of time the employees spend in performing work on specific orders, or in the case of piece workers, the quantity produced. This is a check on their efficiency and also provides data for calculating the labor cost of operations. In other words, the clock cards show the total time which the employee works and the day wages which he should receive therefor, whereas the job cards are used to check the amount of work which the employee does in return for the wages which he receives, and to record the cost of this work by operations.

There are great diversities in the form and use of work tickets or job cards. Two general problems arise in this connection that deserve some detailed consideration: (1) whether there shall be a card for each operative for the entire day or week, or separate cards or tickets for each separate job on which he works, and (2) whether the record of starting and stopping time shall be *written* by the workman or time clerk, or recorded by some time stamping mechanism. The two matters are more or less interrelated and must, on that account, be considered together.

A job card should show the employee's number, order number on which he worked, the date, the machine, the operation, the starting and stopping

time (from which the elapsed time is calculated) and the employee's rate. It may also show the labor cost, the machine or burden rate, and the burden cost. If a bonus or premium plan is in operation, space must be provided for this data also, and usually under such a plan, and always on piece work, quantities will also be shown.

Of the two kinds of job cards in common use the older style is to have each employee write a time card for the day or week, on which he records the time of starting and stopping each job.¹ This method is objectionable in that it calls for clerical work on the part of the employees, it takes more or less time from their work, and affords an opportunity for juggling charges between different jobs, in case they consider this to be to their advantage. It most certainly invites broad guesswork as to starting and stopping time, unless recorded by some kind of a time stamp, and frequently causes a certain amount of feeling, because the workmen consider themselves the victims

¹ In case this plan is used without time stamps, it is decidedly preferable to design a form of job card having the hours of the working day with the desired fractional divisions printed on the cards, so that the workman can record the period or duration of elapsed time by drawing a line (indicating elapsed time between starting and stopping time) from one printed division line to another.

of red tape and do not appreciate the importance of the records which they are making.

Because of the above objections to workmen making their own tickets, a time clerk is frequently employed to circulate among the men and record the starting and stopping time on each job, or possibly this may be done by the foremen. Where any considerable number of men are handled in this manner, there is bound to be some delay in getting the information from them. The workmen frequently make memoranda, thus duplicating the effort of recording the time, or if they state the time from memory, errors are quite probable, and a correct distribution of their time is not likely to be secured.

While this method (of daily or weekly time cards) is in very common use, and facilitates comparison with the payroll, it is not the most satisfactory for cost accounting, because of the necessity for posting every item to cost cards, and because none of the information is available for cost accounting until the card is entirely completed. This is particularly objectionable in the case of weekly cards.

The second general method of recording time is on individual job cards, or work tickets, so that every time a workman changes from one job to

another there is a new card on which the elapsed time is recorded. This plan has two marked advantages: viz., (1) that the individual cards can be handled independently for comparison with standards, or the operation of a bonus system; and (2) that the cards may be sorted and *filed*, if desired, by job numbers, so that all posting is eliminated until a summary of the cards is made on an adding machine when the job is finished. In a shop where there is a multitude of small operations, by many different workmen, on the same job or manufacturing order, and conditions justify the omission of the proof (that labor costs are posted to equal the total of the payroll) which a posting of labor cost provides, this method should be used. It is frequently preferred in ordinary shops in comparison with the daily or weekly card.

All the objections against hand-written job cards of the daily or weekly type hold against hand-written cards of the individual type, except that they offer less chance for shifting time from one job to another. There is, therefore, a strong preference for time stamps in all factories that have a well developed cost practice, unless the labor is predominantly piece work.

Where recording time stamps are used on either

of the two general types of time cards, when an employee finishes an operation, the card is stamped, by a clerk or by the workman himself, to show the time the operation was completed. If the individual job cards are in use, the new job card for the operation which is about to be commenced, is stamped at the same time, so that there is no lapse of time between jobs. This method insures an accurate record of time by order numbers, and consequently correct labor costs.

Summarizing Job Cards

When individual or separate job cards are in use they should be sorted by employee numbers when first received by the payroll department, and the total time accounted for by the job tickets compared with the total time the employee was in attendance during corresponding periods, as indicated by his clock cards. This comparison may be made daily or weekly, but either way it is important.¹ Unless it shows that job cards have been turned in for each employee's time in full, an investigation should be made as to why an employee's time was not entirely accounted for.

After the time cards (of either kind), as turned in by each employee, have been compared with

¹ See note, page 48.

the clock cards for the same period, the labor cost of each operation is calculated on the time cards, which are then ready for proper distribution and posting on the cost cards, which summarize the cost of manufacturing orders in process and the cost of indirect labor charged to standing orders or burden accounts. This completes a distribution of labor cost which has previously been proven with the total payroll expenditure.

If not posted at this stage, the cards are filed by order numbers. Sometimes cards are filed with only the data of elapsed time, and no money extension. The proof with the payroll in such cases is in respect to **total time only**. This subsequent extension of money value is for summaries of elapsed time in total, and not on individual job cards. When labor is handled in this way, burden must of necessity be figured on totals of elapsed time also.

If labor tickets are filed, and not posted one by one, the credit to Payroll account and the debit to Work-in-Process is necessarily by totals only, that is, all the work tickets of a department for a day or a week may be summarized on an adding machine and the total proved with the payroll summary. Presumably the same values will subsequently emerge from Work-in-Process when jobs

are completed and summarized. There is no assurance, however, except taking care of individual slips of paper, that charges do not get lost before posting.

Practically, this is not an objection worth considering in an office that is well organized and accustomed to doing careful, orderly, detailed work. A proof may be made at any time by summarizing the values on the filed cards representing the inventory of Work-in-Process.

When there is a detailed distribution of burden, it is sometimes advantageous to figure burden charges on the time cards or work tickets. When this plan is followed one of the first operations to be performed in the cost department is to calculate these charges. Each job card should show the number of the machine on which an operation was performed. The elapsed time for calculating burden on the operation will be the same as the elapsed time reported for the employee. There should be a schedule of machine rates (determined as described in subsequent chapters) in the cost department which is similar to a schedule of employees' wage rates in the payroll department. From this information the proper burden charge for each operation can be calculated and entered on the time card.

Even when the work tickets or job cards are extended only for a labor distribution, they must nevertheless record the machine or production center at which the work is done, as this information is needed for the subsequent burden distribution.

Sometimes it is most convenient to post all the labor charges in groups or classes, to which one rate of burden will apply, and figure the burden on the totals built up in this way.

Another important variable of labor distribution is to merge labor and burden charges together in one rate, and treat this, in posting or summarizing, in all respects like a simple labor rate. Some important technical and practical accounting problems have to be dealt with when this course is followed.

Piece Work Costs

In an industry like shoe manufacturing, where piece rates are almost universal, or in an individual factory in any industry which may have developed the use of piece rates extensively, it is obvious that the labor cost of successive operations (and so far as the product is made entirely by piece work, the labor cost of the completed article) is as accurately known in advance as after the work has been accomplished.

Under conditions of this kind, the matter of chief concern is to provide an adequate payroll audit, in order to make certain that only work done is paid for. This frequently involves a problem of inspection, so that the management may be sure that only work that is *adequately* and *properly* done is paid for. In other cases it is merely a question of quantity, subject to defective workmanship that may appear in the hands of subsequent operators, as in the manufacture of shoes, or shirts and collars, for example. It is usually found to be very much worth while to maintain adequate check lists, convenient in form, according to the kind of product that is being manufactured, to audit piece work payrolls systematically. A check of this kind can frequently be made to serve as a tracing list also, so that the management sees just how many pieces of a given lot have been completed, or how far the entire lot has progressed from one operation to another.

In smaller factories where there may be an opportunity for a few of the employees to have both piece work and day work, the most rigid system should be observed to see that workmen do not get paid at day rates during time that they are actually engaged on piece work operations. This is partly a question of seeing that no individual

cheats the company, but that after all is not as important, perhaps, as the possibility that one dishonest man, taking advantage of an opportunity like that which may come his way, will create dissatisfaction among his fellow employees. The injustice to them, and the dissatisfaction which that will cause, may actually hurt the management more in the long run than the loss from the individual cheating.¹

When there is piece work, many managers consider it unnecessary to record the elapsed time on successive jobs or operations. If elapsed time is not recorded, it is obviously impossible to apply burden on any basis that has a time element (man-hour rates or machine-hour rates). Under these circumstances the only practical alternatives are to reckon burden as a percentage of direct labor, or to establish standard burden rates per unit of weight or time, exactly analogous to the labor piece rates. When the labor charges are at piece work rates, the objection to applying burden as a percentage on labor cost may not be

¹ This is a general principle of factory management which applies in regard to the safeguarding of materials, and the enforcement of factory discipline in many ways, although no example is perhaps more common or more generally understood than that mentioned above, which arises in connection with piece work and day work for the same employee.

quite as serious as on miscellaneous day work, for obviously the labor cost on different lots of the same quantity will be uniform, and not subject to the variations that would naturally occur if day workers, at varying rates, were employed on successive orders of the same article.

If the piece workers, however, show any considerable variations in production, the elapsed time on successive orders of the same quantity will be different, and the burden, which after all bears on different kinds of work chiefly in proportion to time, will be different, and the difference should be recognized and reckoned if possible.

A great many managers will want to know the relation between the piece work earnings of their employees and the time spent on different jobs, and on that account will insist on a careful record of elapsed time. If any kind of a bonus plan is in operation the record of elapsed time is indispensable, and as many bonus plans have something in the nature of a piece work basis, this will very likely be a controlling factor in deciding on elapsed time records for many operations that are not done by straight day work.

Payroll Bookkeeping

The total payroll summarized by the payroll de-

partment, with a distribution of the corresponding money values to order numbers, gives a credit to the Accrued Payroll account, and a debit to the Labor-in-Process account. When the workmen are paid there is a credit to the Cash account and a debit to the Accrued Payroll account for the amount drawn from the bank. The amount of Labor-in-Process as shown by the balance in the account by that name (as a subdivision of Work-in-Process) is supported by the labor charges posted to the cost cards, or in the file of work tickets on unfinished orders.

The method of proving the accuracy of the burden charges which are posted and summarized at the same time will be explained more fully in subsequent chapters dealing with the distribution of burden charges.

CHAPTER V

METHODS OF APPLYING BURDEN

Many cost accounting installations which are thoroughly dependable as far as material and labor costs are concerned, fail because of inaccuracy in handling the third element of cost, viz.,—overhead charges or burden. This condition of affairs is entirely unnecessary. If burden charges are given the proper study, they may be analyzed, distributed, and charged to cost with great accuracy, thus insuring a correct total manufacturing cost.

Methods of Applying Burden

There are several methods of applying burden charges to cost, those principally employed being as follows:

1. Percentage on wages
2. Percentage on labor and material
3. Man-hour rate
4. Old machine rate
5. New machine rate

The first three methods are well known, the old machine rate is rarely used, and the new machine rate, for reasons given at length in this volume, is coming to be accepted as by all means the best to use **under conditions to which it applies.**

Percentage on Wages

The percentage-on-wages method has been commonly adopted and is perhaps best understood. By this method the burden of a plant is analyzed to determine the amount which belongs to each department, and the departmental burden is expressed as a percentage of the direct labor cost in each department. When the burden is 100 per cent., the burden charged to each job equals the direct labor cost. If it is 150 per cent., the charge is 150 per cent. of the direct labor cost, or one and one-half times as much.

The percentage-on-wages method is undoubtedly convenient, and if the shop in which it is used carries men on the payroll at a nearly uniform wage rate, and they all work under substantially the same physical conditions, and use substantially the same equipment, the application of burden will be tolerably accurate.

There is, however, no fixed relation between the wage rate of an operative and the equipment which

he uses. It is quite probable that men at the highest wages in the shop will be working under conditions that would make a very modest burden rate appropriate. Skilled men engaged in assembling or bench work would be in this class. Other men in the same shop, at much lower rates of pay, possibly apprentices, will be assigned to work with tools or equipment that carry very high burden rates on their operations. The lower paid men furthermore are apt to incur larger overhead charges in respect to such matters as supervision or instruction. Except on remarkably uniform operations and with uniform wages, we must discard the percentage-on-wages method when precision in cost accounting is desired.¹

Percentage on Labor and Material

The percentage-on-labor-and-material method is similar to the percentage-on-wages method, except that the burden charges are added as a percentage on total labor and material cost rather than on labor cost alone.

This is usually the worst possible way to distribute burden, for the reason that manufacturing overhead or burden almost never has any direct relation to the value of the material used. It may

¹ See page 9.

be related to weight, size or some physical quality, but practically never to value. To introduce this unrelated element as a basis for calculating burden cost tends to obscure the relation which does exist between workmen's efforts and burden.

Man-hour Rate

The man-hour rate method contemplates dividing the total burden of a plant, usually analyzed by departments, by the number of direct labor hours in each, deriving a rate per man-hour. Burden is added to cost at this rate per hour for the time which it takes to complete each job.

The man-hour rate avoids the objections to the percentage-on-wages method which arise because different men in the same shop are paid different rates of wages, and burden applied according to this method is not more or less for a given number of hours because the wage of the operative is higher or lower. But the man-hour method takes no account whatever of the variations in equipment which may be placed at the disposal of different workmen, and in that respect it fails just where the percentage-on-wages method fails. Where the operatives are working under practically uniform conditions in respect to equipment, the man-hour rate will serve very well, but when

we come to consider the diverse conditions represented in an ordinary industrial plant, something more comprehensive and more precise is required to provide any exact and useful information.¹

Old Machine Rate

The old machine rate method is somewhat similar to the man-hour method. The total expense of the plant, usually analyzed by departments, is divided by the number of machines in each to give an equal machine-hour charge for all work. Burden is then added to cost in proportion to the number of machine-hours required to complete a job. In departments where the class of work is such that each operator has one machine, there is no difference between the man-hour and the old machine-hour rate. There are many classes of work, however, where the employees operate more than one machine at a time, and in such cases, the old machine-hour rate and the man-hour rate would differ.

New Machine Rate

The new machine rate method contemplates the analysis of all the factors making up the manufacturing burden, in order that the proper over-

¹ See page 8.

head may be known for each department, and usually for the production centers in each department. This total burden, determined by departments and production centers, divided by the standard number of operating hours in a year, gives a machine-hour rate, which is used to charge burden to the cost of orders in proportion to the length of time which each order uses the manufacturing facilities afforded by a production center.

An application of burden in proportion to work actually done, and the setting apart of unearned burden, is an important and logical corollary of burden distribution by this plan.

Definition of Production Center

A production center may be defined as a machine tool, bench, or section of assembly floor used for carrying on a manufacturing operation. A department in the ordinary sense of the word may consist of any number of production centers. For practical accounting purposes, production centers performing similar operations, representing similar investments, and incurring equal operating charges, may be combined. The term production center as used in this book may be defined, therefore, as a manufacturing unit, or a group of units

performing similar operations and incurring substantially the same expense per hour used for fixed and operating charges.

Weakness of Old Methods

The great weakness of burden charges made by the percentage-on-wages plan, or any of the older methods described above, is that they all contemplate charging the burden of the entire plant, or at best of an entire department, at a uniform rate, of one kind or another, on the work done in all production centers. As a matter of fact the nature of manufacturing operations performed in different production centers calls for widely varying investment in equipment, varying demands for power, for supervision and other items making up burden. This fact is entirely disregarded if a uniform percentage of the labor cost, or a uniform rate per hour, is added to the cost of the work done in all production centers. Some work is then charged an excessive amount of burden, whereas other work is in reality much more expensive than the cost records indicate.

There has been so much material published in the last five years, pointing out the advantages of a development of burden charges by production centers as compared with other methods, and

this plan has met with such a favorable reception, that a great many machine shops and similar establishments have made some effort toward its adoption. But merely to charge an estimated burden to cost through machine rates does not meet all the requirements of the case.

It is a fundamental mistake not to check the burden charged to cost through the machine rates with the actual burden during corresponding periods.¹ Unless this is done, machine rates, developed in an effort to secure accurate costs, may be so inaccurate as to lose much of their potential value.

Another factor tending to destroy the value of cost records is the manner in which varying production is usually allowed to influence the amount of burden charged to cost. The common practice is for the calculated burden in a department to be compared with the current volume of production. This comparison results, of course, in burden rates that rise (when expressed as a percentage) as the direct labor payroll diminishes, and a fall-

¹ It is equally a mistake to omit the necessary check on any other kind of burden methods. If the percentage-on-labor or the man-hour methods are used, control should be established to make an accurate comparison between the amount of burden applied and charged to cost and the amount of expense burden actually incurred.

ing rate when the direct labor payroll increases. The fact is that the product actually made and sold in periods of diminished output may be made more economically than previously, because improved methods and greater skill make it possible to finish individual jobs in a shorter time than formerly. When current production shows equal or increased efficiency in comparison with previous performances, it is only absurd to obscure this real economy, or increase in efficiency, by a purely nominal, and in fact an altogether unreal, excess rate of charge for burden, which serves only to inflate the **apparent** costs.

Assuming that machine rates have been carefully determine, and that the accuracy of these rates is continuously checked, all of the burden will be charged to cost if the plant operates at full capacity. During periods of curtailed production, when the plant may be running at much less than capacity, the machine rates will not distribute all of the burden.

Mr. A. Hamilton Church has proposed¹ the practice of charging this undistributed burden to the product made by means of a "supplementary rate." The obvious result is to give the same

¹ "The Proper Distribution of Expense Burden," Chapter III.

meaningless rise and fall in *total* cost as under the old methods.

There is a further marked disadvantage in attempting to apply the supplementary rate in that no cost is final until the supplementary rate is applied, and the supplementary rate is not known until the end of the accounting period. This is a very serious practical objection, not only because there must be a long wait after the close of the month or accounting period to determine the supplementary rate and apply it to the orders worked on during the period, but if any attempt is made to bring the work to a conclusion in time to have it of any interest to the executives, there is an appalling pressure of work on the clerical force after the closing, and relatively little that can be done effectively until the next closing.

Under the old and familiar percentage-on-wages method, as usually applied, or with the cumbersome and unsound supplementary rate, the costs *seem* low during periods of active production, while during periods of curtailed production costs *seem* high, since all of the burden is distributed over a greater or less volume of manufacture. Thus a varying production, which is entirely beyond the control of foremen and operatives, apparently affects the cost of work done by them.

Although the theory of adding a supplementary charge to actual costs is unsound, the supplementary rate does serve as a kind of index of shop conditions; with the straight percentage-on-wages method, the management misses entirely any true comparison of the efficiency in the shop at different times.¹

Contrary to the general practice stated above, the fact is that only a part of the total burden is chargeable to the manufacturing cost of the product made during periods of curtailed production, the part chargeable being the same percentage of the total burden, as the curtailed production is of the standard production.² The burden not

¹ This criticism of the percentage-on-wages method applies with equal force to all methods which do not recognize a normal volume or operating time, and a corresponding standard burden rate.

² In view of certain articles, put forth in the fall of 1915, by a well known engineer, apparently taking credit for the discovery or first statement of this principle, the author wishes to state that he made practical and effective applications of the idea in the accounting practice of important and well known clients beginning in the spring of 1911, and gave it wide publicity in an address before the National Association of Machine Tool Builders on October 22, 1913. This address was not only reprinted in the annual report of the Association, and the *Journal of Accountancy* of January, 1914, but the sections significant in respect to this discussion were also quoted in the *Iron Age* of October 30, 1913.

chargeable represents the cost of unused capacity for manufacturing, and is a charge direct to Loss and Gain. (See pages 184-187.)

In order to show the trend of manufacturing efficiency through comparative cost records, a method must be provided which removes the influence of varying production from factory costs, so that the undistributed charges, properly termed **unearned burden**, will not conceal the real facts. Such a plan has a double advantage in that it not only gives accurate manufacturing costs but also, once the true significance of unearned burden is understood, serves as a valuable aid to the adoption of comprehensive manufacturing and selling policies.

A manufacturing cost is not necessarily correct because of carefully determined material and labor charges. Burden charges must also be accurate to give an accurate total. In order to make these charges accurate, the burden of a factory must be analyzed by departments and production centers. The machine rates used as a result of this analysis must be constantly checked by a proper accumulation of current charges,¹ and a plan must be established for removing the influence of varying production on manufacturing costs.

¹ See footnote, page 68.

Elements of Burden

The following analysis shows the typical elements of burden in a manufacturing plant.

(1) Rent	} Fixed Charges	} Direct Production Center Charges	} Total Manu- factur- ing Burden
(2) Equipment Charges			
(3) Repairs	} Operating Charges		
(4) Indirect Labor			
(5) Supplies			
(6) Power and Steam			
(7) Planning, Cost, Payroll and Other General Manufacturing Expense	} General Burden		

The first element of burden to be considered is rent, or in other words, the annual cost of providing space in which to carry on manufacturing operations. This is a cost element, as explained in detail in the succeeding chapter, even when a manufacturer owns the buildings which he occupies. The next item of expense is an equipment charge for interest, taxes, insurance, and depreciation, on the equipment which is necessary in each production center in order to perform the desired manufacturing operations. The amount of this

expense varies with the investment which it is necessary to make, and also with the nature of the operations and true depreciation charges.

In some instances, notably in the case of building repairs, the fixed charges should preferably include repair costs in addition to the costs mentioned above. The expense of building repairs is likely to be large during some years and small during the years immediately following. Handling this expense as a fixed charge serves to distribute it to cost in equal annual installments, rather than in widely varying amounts as is the case if the expense is charged to cost as it is incurred.

Rent and equipment charges are fixed charges. In other words, production may be discontinued and the plant closed, but the investment in buildings and equipment remains, and the fixed charges for interest, taxes, insurance and usually depreciation are undiminished.

When manufacturing operations are carried on, there are certain direct operating charges to be considered. These are repairs (unless scheduled as a fixed charge), supervision and indirect labor, supplies, spoiled and damaged work, and power and steam. These expenses should be calculated in total, and subsequently analyzed and distributed to departments and production centers in propor-

tion to the service which each receives. The fixed and operating charges which can be apportioned directly to production centers are termed direct production center charges.

In addition to these direct production center charges, there is a general manufacturing expense for planning, payroll, cost accounting, and other general manufacturing expenses. (In a large plant much of the operating expense of this kind may be a direct charge to definite departments.) This general burden, plus the direct production center charges, makes up the total manufacturing burden of a plant.

Distinction Between Manufacturing and Selling Expense

It is very important when distributing burden charges that a definite distinction be made between manufacturing and selling expenses. Selling expenses should be kept entirely separate from manufacturing costs, and in making an analysis and a determination of manufacturing burden, one of the first steps should be to go over all expenses and decide which are manufacturing, and which selling expenses or administrative expenses not properly manufacturing.

CHAPTER VI

FIXED CHARGES

Before making any calculations as to the annual cost of rent and equipment charges, it is necessary to give some preliminary consideration to the kind and amount of the fixed charges which a plant incurs. These fixed charges are for interest on investment,¹ taxes, insurance, and depreciation. It is often advisable to treat repairs also as a fixed charge, either separately or on a joint account with depreciation. In either case the estimated expense is set up on the books in the form of a reserve, and the actual expense for repairs charged against the amount of the reserve.

Plant Appraisal

The amount of interest to be charged to cost (the rate having been agreed upon) is in direct proportion to the investment which has been made in buildings and equipment. Tax and insurance charges increase with the plant investment (unless the plant additions are of an uninsurable na-

¹ See Chapter VII.

ture, like land or foundations). Depreciation charges vary with different kinds of buildings and equipment, and increase as the investment is increased. A complete appraisal of the plant is therefore necessary before undertaking a calculation of fixed charges.

This is not usually a very difficult requirement to meet, however, since many plants make a practice of having their property appraised frequently, and many others carry perpetual plant inventories in the form of a card or loose-leaf record.

Taxes

Property taxes are based on an assessed valuation of plant and in some instances on inventories as well. This valuation is charged for at a tax rate varying according to the community in which the taxable property is located. The annual cost of taxes should be distributed to production centers in proportion to the extent to which they contribute towards making up the assessed value. The assessed valuation of a manufacturing plant is usually less than the book valuation or a fair appraisal valuation.

To simplify the distribution of tax charges it is desirable to express the cost of taxes as a rate per \$1,000 based on appraisal values rather than as-

sessed values. This is a simple rate to determine, however, when the total tax and a fair appraisal value for the plant are known. With this information, the proper tax rate per \$1,000 of appraisal value can be calculated.

Other taxes vary greatly in different states, and each must be considered on its merits and charged against the classes of property taxed.

The Federal Income Tax, or any other tax levied on net profits, is no part of manufacturing costs. Obviously an article has not *cost* more or less to make because it is sold at a profit or otherwise.

Insurance

The most common form of insurance is fire insurance on the plant. The cost of fire insurance depends primarily upon the amount for which the property is insured, the charge being most frequently figured at a rate per \$100 insured. This rate varies according to the fire hazard. A study of insurance bills will show the total annual expenditure for fire insurance. For the purpose of distributing this cost to production centers, it is convenient to express it as a percentage of the appraisal value. Knowing the cost of fire insurance, and the appraisal value of the property in-

sured, the determination of this percentage is simply a matter of division.

In addition to insurance against fire, insurance is carried against boiler explosions and bursting fly wheels. Such expenses are chargeable in total directly against the cost of steam and power.

Employers' liability insurance is now carried by many manufacturers. In some states there is a compulsory provision for workmen's compensation. The expense of this form of insurance varies directly in proportion to the number of employees and the relative danger connected with the operations which they perform. This expense can be distributed to departments and production centers exactly in proportion to the payroll, taking into consideration the different rates charged for the classes of operations performed.

When the charge is conspicuously small in proportion to the total burden it may not be worth while to distribute it separately, but rather to let it go into general burden which is distributed as described in Chapter XI.

Relation Between Depreciation and Repairs

To keep the plant in good operating condition, repairs must continually be made to the equip-

ment. In spite of current repairs to equipment, however, the time will come when it is not worth while to incur the expense necessary to repair a machine, perhaps because it has been superseded by newer and more efficient models, or because the machine has deteriorated to such an extent that it cannot be economically repaired. The loss of this former asset is a depreciation charge.

In practice, it is frequently hard to decide whether an expense should be charged to repairs or as an offset to depreciation. As a general rule, all minor expenses should be charged to repairs, whereas more expensive charges for extraordinary repairs which may lengthen the life of a machine, may properly be charged against the reserve for depreciation. The decision in any given case should be an honest one, not influenced by a desire to make a showing either on assets or profits.

Furthermore it is of the utmost importance that depreciation be treated as a matter of principle and not one of expediency to be dealt with year by year. Plant and equipment are deteriorating and the "procession to the scrap heap" goes on irrespective of profits. There is a temptation when a company has had a bad year to write off less, perhaps with the self-delusion that land has appreciated enough to offset. Even if that be true

(which is most unlikely) and the company has assets equal to a year before, there is still the deterioration and obsolescence of the buildings and equipment, and **all of that is part of the cost of manufacturing.** This statement holds true even when an attempt is made to cover it up or ignore it in the accounts, by omitting any entry for depreciation.

Depreciation

Depreciation charges are based on the estimated life of the buildings and equipment making up the plant. When the plant appraisal is summarized, it should be so arranged that all buildings of a similar type of construction are included in the same group. For example, wooden buildings in one group, brick and steel buildings in a second, etc. Similarly, machine tools, power plant equipment, transmission equipment and small sundry equipment should be grouped by classes on which like rates of depreciation can be used. After grouping the appraisal in this manner, the life of each class of equipment should be estimated and the total annual charge to cost and credit to reserve for depreciation determined by dividing each investment by its estimated life and summarizing the several charges.

Plant Accounts and Depreciation Records

The ideal way to record depreciation is to have the asset accounts for equipment supported by a detailed loose leaf or card record, on which each individual piece of equipment is shown with a complete description (age, cost, installation, etc.) and its asset value, with information as to the amount of depreciation accumulated in the reserve on account of this individual asset item from year to year. If this plan is maintained in complete operation, the total of the Reserve account may be proved if desired by the accumulation of the individual reserve details, exactly as the equipment asset account may be proved by totaling the individual asset items.

If such a detailed record is kept, information will be available for the proper entries when any piece of equipment is sold or discarded. The amount carried as an asset on account of such equipment items will be taken out of the asset account by a credit thereto. The amount in the depreciation reserve on account of this item will be taken out of the reserve account by a debit thereto.

The other factor to be considered is the sale price or scrap value of the machine. If the sale price should exactly equal the difference between the asset and the reserve, the debit to Cash (or

Accounts Receivable) for the sale of the machine and the debit to the reserve account would exactly equal the required credit to the asset account. There will never be this exact equality, however, and the difference between the amount carried as an asset, on one hand, and the sum of the reserve therefor and the sale price of it when discarded, on the other hand, will be a debit or credit to Loss and Gain, if desired through an account called Miscellaneous Gains and Losses.

There is something to be said for making the credit to the asset account in three parts, so that by reference to the asset account one would see (for any particular piece of equipment that was abandoned) how much had been accumulated in the reserve, how much was realized as the sale price, and how much was charged off as a miscellaneous loss. If the record is kept in this form, the entry to the credit of the asset account for the reserve item should correspond exactly with the charge to the reserve account, and be so entered in both places that the items can be exactly identified.

If a machine really has a second-hand value but is not immediately salable, the second-hand value should be conservatively estimated and set up in a subdivision of the equipment account for

second-hand machines. The amount so set up will take the place of the debit to Cash or Accounts Receivable in the calculations described in the preceding paragraph. When the second-hand machine is subsequently sold the asset account for the second-hand machine will be credited with the amount at which the second-hand machine is carried, and any difference will be charged or credited to Miscellaneous Gains and Losses.

A Simpler Method

The program in respect to depreciation reserves defined in the preceding paragraphs obviously requires a good deal of detailed record keeping, and while it is considered worth while by those companies which have set up their records on this basis, substantially satisfactory results can be accomplished by a much simpler method.

The charge to cost will be made, and the credits to the reserve accounts will be created, by the simpler method in exactly the same manner as by the more detailed plan outlined above. The difference comes when equipment is sold or discarded. In such an event the asset account will be credited with the original value (cost or appraisal) of the equipment, exactly as on the more detailed plan,

but the difference between the sale price and the asset value will be debited directly to the depreciation reserve.

Extreme simplicity with respect to this entry can be secured when equipment is scrapped by ignoring at that time its scrap value, and charging off the entire value of the asset to the depreciation reserve. If this is done the logical thing is to credit the proceeds of any subsequent scrap sales to the reserve account.

This is known as the group or pool method of handling depreciation, and as already noted, has the obvious advantage of simplicity in operation. The theory in support of this practice is that it is impossible to define depreciation with precision in respect to individual assets, but that it is possible to set a fair rate to be applied to a class of assets. If it is assumed that on the average the individual items will last twenty years, the rate is 5 per cent; if the assumed life is ten years, the rate is 10 per cent. If an individual machine is discarded, it is sure to be ahead or behind the average, and other machines to which the same rate applies may have been scrapped years before, or may be continued in service years afterward.

If repairs and depreciation are to be treated together, as it is frequently most convenient to do,

the group plan must of necessity be adopted. (See page 90.)

When depreciation is handled according to this method, only the asset account can be proved by accumulating details to agree with the ledger total. (A test of the reserve can be made by sorting asset cards to classes by rates, and then reckoning the reserve that is applicable on the basis of the age of the machines.) The credit balance in the depreciation reserve will then be considered to apply to the entire asset group for which it has been created, but not against individual assets. If the equipment is scrapped more rapidly than the original rate of depreciation contemplated, the balance of the reserve will be diminished. If the original rate was high because the wear and tear or obsolescence of the equipment proves less than was anticipated, the reserve will grow.

One very important factor to be considered in choosing between reckoning depreciation on the basis of a detailed record of plant equipment and the simpler method is that in a plant of any size, in which equipment and machinery are freely discarded to make room for more productive units, it is impossible to tell from the totals of the accounts alone whether the amount of depreciation set up is sufficient. The amount of the reserve may

seem fair in proportion to the value of the assets, but unless we know the age of the machines still in the plant we cannot say accurately whether the reserve is sufficient or not.

Furthermore in a plant making frequent changes to keep its equipment up to date, the equipment is frequently sold at a figure considerably less than the asset value and even less than the difference between the asset value and the reserve, in order to make way for more efficient machines. This is one of the most important factors to be considered in arriving at a fair rate of depreciation and therefore all of the facts possible in this connection should be collected and recorded.

The individual plan thus offers peculiar advantages for checking depreciation but the weight of experienced opinion is probably in favor of the group plan, because of its simplicity in operation and because under average conditions it meets the practical need of an ordinary manufacturing establishment in a very satisfactory manner.

How to Write Off Depreciation

There has been considerable material published discussing methods of writing off depreciation. Some advocate charging off depreciation in equal annual installments, while others argue that de-

preciation on diminishing values should be used. It would seem that a decision to use any of the proposed methods should be based on a consideration of the relative accuracy to be secured. As a matter of fact, the estimate as to the life of a machine will probably be the greatest error introduced into the calculations. Since this estimate cannot be avoided, too much importance should not be placed upon the exactness with which the estimated cost of depreciation is distributed over the life of the machine. For cost accounting purposes, it would seem that the important thing is to estimate the life of a machine carefully, and having done this, the expense of depreciation may be distributed without increasing the error and with the least clerical work, by equal annual installments over the life of the machine.

One detail in respect to bookkeeping for depreciation deserves special mention, namely, that the amount charged into cost should be credited to reserves and not deducted from the asset accounts. If the asset accounts (which should be properly increased for new construction and diminished for the value of plant or equipment scrapped) are also written down for depreciation, they soon become merely total values, which are more or less meaningless according to the rate of

depreciation and the number of years it has been applied.

Depreciation accumulated as a credit in the reserve account on the other hand always shows exactly what the management has done in respect to provisions for depreciation, and leaves the asset accounts to represent the cost of the property, with its successive additions or subtractions.

Repairs as a Fixed Charge

The cost of repairs is an operating charge, but frequently for practical reasons this expense is handled as a fixed charge, similar to depreciation, or more properly speaking, as a deferred charge or credit, which it is desired to distribute in equal amounts over several periods, rather than entirely to the period during which the expense was incurred.

A good illustration of this point is the expense of building repairs. This expense is of such a nature that a plant may go along for several years with very slight charges for building repairs. At the end of say five years, it may be found necessary to paint the building, or perhaps to make extensive repairs on the roof or flooring. To charge the expense of these repairs against the cost of the product manufactured during the

period when the repairs are made, would obviously be unfair, since the deterioration necessitating the repairs has been going on continuously for several years, and the product manufactured during that time has had the benefit.

It is much better, from a practical point of view, to estimate the cost of building repairs and set this estimate up as a reserve. Actual repair charges will be made against this reserve which will check its accuracy. It is to be expected that during some years the actual charges will be less than the estimate, whereas in other years the actual charges may be much heavier than the estimate. The actual expense of keeping the buildings in repair over a period of several years, however, will have been distributed to cost at a uniform rate during that period, which is a desirable result.

Where this plan is followed, a reserve account for depreciation and repairs combined may be conveniently operated. This account receives credit at regular intervals with an amount which is estimated to be sufficient to meet the average cost of repairs and leave an accumulated balance in the account sufficient to offset the ultimate cost of depreciation. The corresponding charges made to cost during the same intervals are then at a uni-

form rate from year to year. The current expense of repairs is charged against the reserve. Thus the balance in the account represents principally a reserve for depreciation, although during years when the actual expense of repairs has been slight, the reserve will accumulate more rapidly to offset the more costly repair charges which are likely to be incurred in succeeding years.

Fixed Charges on Inventory

In connection with the subject of fixed charges which has been considered in some detail on the preceding pages, it should always be borne in mind that there are fixed charges on plant inventories of all kinds, as well as on real estate, buildings and equipment. Inventories of raw material, finished parts or completed products occupy space, and the rent of this storage space is one of the costs of carrying inventory. Where a plant has severe physical limitations, it is often a controlling factor, and finds expression to the effect that the company "cannot afford to have more extended storage space in a district where room is exceptionally valuable," or, as may sometimes be true, when the space is more urgently needed for manufacturing.

Inventories must be insured; they are usually subject to taxation; they tie up more or less cap-

ital, according to the value of the product, so that the interest on investment in inventory, as well as taxes and insurance, must be reckoned as fixed charges.

In many industries it is of the utmost importance to have a well considered policy in regard to inventories, for while they will cost the business a considerable sum to carry, they make for economy by permitting manufacture in larger lots, and give satisfaction by the prompter execution of rush orders, or better service to customers in respect to both repair parts and many kinds of finished merchandise. The parts, of course, would be used for hurried assembly orders, and it may be the best possible policy to carry a large inventory of the parts which are relatively small in size, and take a long time to manufacture. These stores can be drawn on while the shop is getting out the bulkier or simpler parts to finish machines that may be required quickly, and may not be on hand ready to ship when the customer's order is received.

In an establishment, such as an automobile factory, where manufacture is largely a matter of assembly of parts purchased from other factories, the cost of carrying inventories sufficient to keep an even flow of manufacturing may be one of the

serious costs of doing the business, although obviously less than if the establishment made everything from raw material.

There are many sorts of finished merchandise from which customers expect immediate shipment, as is the case in filling up on sizes of shoes, shirts and collars or securing different articles of the same pattern, such as silverware. The small local dealer will carry knives, forks and perhaps teaspoons, and will rely on the factory for those articles of the same pattern which are somewhat less staple and in less constant demand. In many other lines, as diverse as implements and food products, it is an essential part of the factory policy to carry an adequate stock of finished goods ready to meet promptly customers' requirements.

It may not be as clear on first sight, but it seems just as obvious upon analysis, that there is a fixed charge for carrying an inventory of Work-in-Process. In many cases, in fact, this is the largest inventory that a manufacturing plant will have. The space factor, which might properly be assessed against storerooms used for raw materials, finished parts or completed products is, in respect to Work-in-Process, assessed against the machines or the departments of the factory. The fixed charges for taxes, insurance and interest on the in-

vestment will vary according to the volume of the Work-in-Process inventory, and should accordingly be reckoned on the value thereof, preferably from month to month.

If the factory production is so departmentalized that these fixed charges can be allocated definitely to different kinds of work, that is obviously the correct procedure. This is another excellent illustration of general charges which become actual and definite under adequate analysis.¹

That there are fixed charges on inventories seems to be beyond debate. The cost of carrying raw materials or Work-in-Process inventories is certainly a manufacturing cost, and probably also the fixed charges for carrying a finished parts inventory. There is an opportunity for some difference of opinion as to the proper disposition of the cost of carrying an inventory of finished merchandise. If it is an indispensable condition for the kind of manufacture that is being carried on, it seems simpler to reckon the cost of carrying the merchandise inventory as a manufacturing cost along with other fixed charges of a similar character. This would be even more obvious in respect to an inventory of finished parts.

If it is a matter of debate, however, whether

¹ See Chapter XI.

extensive inventories shall be carried for customers' convenience, it is quite possible that the cost of carrying will be regarded by some managements as a selling expense. The author has in mind two paper mills, for example, whose annual product is about equal. One as a matter of policy carries a large inventory of assorted colors, weights and sizes of finished product, ready for immediate shipment. The other mill manufactures almost exclusively in large lots upon receipt of customers' orders, and consequently has a very small inventory of finished goods, and accumulates only inconsiderable fixed charges on that account. These two policies would undoubtedly be contrasted chiefly from the point of view of the sales organization, and although most paper mills that have an adequate cost accounting reckon all their inventory charges as a manufacturing cost, it is quite conceivable that some paper mill managers might take a different view, or that the circumstances in respect to inventories, finished ready for customers' use, might be entirely different in another industry.

For a discussion of fixed charges on accounts receivable, the reader is referred to page 110.

CHAPTER VII

INTEREST CHARGED TO COST

There seems to be a considerable diversity of opinion among executives as to whether interest should be considered as a part of cost. As a matter of fact, few executives or accountants have thought the problem through in a logical way. All objection to including interest on investment in cost must disappear, however, when one considers the fundamental economic theory involved, for most authorities agree conclusively that interest and profits are essentially different in principle.¹ Even if there were not this unanimous academic authority, the practical importance of accounting in this form should settle the matter, for in most cases it is hardly possible to do any adequate cost

¹ It would seem that one might say *all* authorities, for the author has been unable to find in the writings of any modern economist passages from which a quotation could be made in opposition. Those who would like to see how completely the economists agree on this important matter, and moreover how precisely many of them express themselves in terms of modern business life, will be interested to consider the Appendix, in which will be found numerous most significant quotations.

accounting that really distinguishes manufacturing costs, and otherwise meets the needs of a modern manager, on any other basis.¹

Consider the fundamental purposes of cost accounting and the effect which the inclusion or exclusion of interest charges has on their attainment. First in order, but not in importance, is that of determining manufacturing costs as a basis for proper selling prices. Second, is that of securing an administrative control over expenditures for material, labor and burden, **in order that the economy of their use may be known and maintained.** Third, to serve as the basis for the formation of intelligent manufacturing and selling policies.

Interest is Part of the Selling Price

In fixing selling prices, everybody will agree that interest on the capital invested, or in other words, interest on the plant and inventories which are the equivalent of capital, must be taken into

¹The exceptions to this general statement are found only in such industries as flour milling, coal and some other mining, cement or brick manufacture, when the entire output of the plant is one substantially uniform product. Even then, Unearned Burden, as later defined and expounded, Chapter XII, is not seen in its full significance when interest on the investment is omitted.

consideration *at some point*, for if the net profit resulting from trading does not exceed the amount which the capital might earn invested in standard bonds yielding ordinary rates of interest, then from an investment point of view the business is not worth while. The only question is then at *what point* in the accumulation of a total cost to sell, interest should be included. The effect which the inclusion of interest has on the accomplishment of the other aims of cost accounting, indicates conclusively that it should be included as a manufacturing cost.

Cost of Carrying Inventories

The case might be cited of a manufacturer who had a poorly organized purchasing department, a lax stores system and inadequate planning and production methods. In order to carry on his business, he had always found it necessary to carry inventories of raw material, work-in-process, and finished stock amounting to approximately \$500,000. If he is able, by a general reorganization of his purchasing, stores and planning departments, to work successfully with half the former investment in inventories of raw or finished material, he can cut in half the investment cost of carrying them.

Efficiency of Varying Equipment

To determine the relative efficiency of different manufacturing methods interest must be taken into consideration. To use a simple illustration, suppose that a manufacturer finds that he must buy a new machine to perform a particular operation. Upon investigation, he may find that there are two machines in the market, one costing \$500 and the other \$1,000, on either one of which it is possible to do the required work. His first thought is that he will tie up less capital by purchasing the cheaper machine, and that it will therefore cost him less to turn out his product on this machine than on the more expensive one. It is the cost of tying up capital, or in other words, the cost of interest at a fair rate on the added investment, which he is trying to keep at a minimum.

These are very simple illustrations, but in the course of circumstances common to any manufacturing plant, there are always problems to be settled which involve not merely the alternatives of purchasing an expensive or cheap machine to perform the same operation, but which necessitate a comparison between all elements of cost at the same time. For example, the installation of more costly machinery to perform a certain process may make a great reduction in the labor and ma-

terial cost of the process.¹ Certainly no fair comparison can be made between the proposed method and a former method which used less expensive machinery, but which required greater expenditures for labor and material, unless the cost of making the additional investment is taken into consideration, or in other words, unless interest on the added investment is figured as a part of the cost of the new process.

Interest in Cost Estimates

It is undoubtedly true that part of the significance of investment, or capital cost, may be brought out by a preliminary calculation made before purchasing new equipment to decide whether or not it will be an advisable step. Merely to *estimate* in advance the relative economy of two processes does not require that interest should be

¹ Modern textile machinery and modern printing presses to supersede hand labor are familiar illustrations of this principle, which is almost certain to have some special application in each individual industry. In the manufacture of steel, for example, highly automatic rolling mills require very much less labor to operate than old fashioned mills which are still sufficiently effective on some kinds of work to remain in use. In the manufacture of candy, expensive machines can be used in place of many hand operations, and on a great deal of construction work suitable machinery will effect a marked reduction in labor costs.

charged to cost in the accounting, but that is necessary in order to *know* that the estimates are realized. Experiments with new machinery and new processes unfortunately do not always come up to expectations. Leaving interest out of current cost reports, would be favoring the new process if it required more expensive equipment than the former method, and a falling off in the expected efficiency would not be detected as quickly as if interest on investment had been made a current charge as well as a preliminary estimate.

Interest and the Time Element

There are numerous industrial operations in which time is reckoned by all concerned as an important element of cost.

In tanning leather, for example, a period of time from 50 to 90 days was required to convert the hides to leather by the slow processes of bark tanning; and one of the conspicuous economies connected with tanning methods which have come into use in recent years, is that the valuable hides can be more quickly converted from raw material to finished product.

In smelting valuable ores, especially those which contain precious metals, and in the subsequent refining operations, the time element is commonly

reckoned as an important factor in cost, and if new methods, otherwise more costly, will appreciably reduce the time required for the conversion, the final product may be made cheaper on that account.

Anyone will agree that, of two alternative processes, the longer is the more costly, other factors being equal. The greater cost for the longer time, in either of the above examples, or in any analogous industrial process, is almost exclusively a cost for the capital invested, and can be expressed only in terms of fixed charges on that capital, which must certainly include interest; and if the commodity is of an insurable nature, and subject to taxation, charges for both of those elements also.

This additional cost for the mere time of the process has for years been clearly recognized by practical men in both of the industries referred to, and they have reckoned interest as part of their costs. They are certainly not in the least concerned with accounting theory as such, but they realize fully that they have their capital invested in a valuable product, and the longer it takes the more it costs to complete the process of converting the product to a salable form.

When any manufacturer uses cheaper materials

in a given product, he not only saves on the purchase price, in comparison with more costly materials previously used, but he also saves on the capital cost of carrying his raw material, work-in-process and finished stock inventories, which for the same volume will be smaller in value with less costly materials.

Practical illustrations of this kind seem to argue conclusively for the soundness in theory and utility in practice of including interest as an element of manufacturing cost.

How Interest Affects Business Policy

The inclusion of interest also plays an important part in the determination of manufacturing and selling policies. During periods of curtailed production when part of a plant is lying idle, or in other words, when part of the capital is not producing, current charges showing all the expense (including interest on the investment) of carrying this unused capacity for manufacturing are much more likely to arouse an executive or a board of directors to action than a mere memorandum of approximate fixed charges prepared as an estimate of the burden on unused manufacturing capacity.

A manager may adopt a policy causing the ac-

cumulation of a considerable inventory of raw material or finished stock. The circumstances may be such as to make this a wise policy, but it is certain that it is expensive, inasmuch as it ties up capital. To get any true conception of the ultimate value of the policy, interest on this inventory must be considered as a cost.

If true costs are to be obtained, it is necessary to charge against the product all of the expenses incident to its manufacture. From this practical standpoint, any expense necessarily incurred in the production of goods is most conveniently, and emphatically most safely, included as a manufacturing cost.

Rate of Interest

The rate of interest which should be charged to cost depends upon the income which the capital might be expected to earn if invested conservatively in high grade securities where no manufacturing or trading risks are taken. For a further discussion of the rate of interest see page 116.

Bookkeeping for Interest on Investment

It may help the reader to gain a clear idea of interest on investment as a charge to cost, and to understand comments that appear from time to

time in articles and pamphlets which touch on this topic, to point out that there are two general methods by which the interest charge may be calculated and applied to costs.

The method which is uniformly much to be preferred is that of determining the asset values of all kinds, wherever found, and calculating the interest thereon as a charge through the various channels of rent, equipment charges, inventory charges,¹ etc., with a corresponding credit to an account known as Interest Charged to Cost, which is a credit each period to the Loss and Gain account, and as such is available for dividends, if not offset by losses of one kind or another. This method, in fact, is the only one that can be worked out in a practical way in an industrial establishment that requires careful analysis and subdivision of its overhead charges or burden.

The "Net Investment" Method

The other method is applicable to trading establishments (with only one kind of inventory, so that

¹ It seems to the author that anyone who understands the principle involved in charging interest on land, buildings and equipment, must agree that it is equally logical to charge interest on inventories of raw materials, work-in-process and finished goods, and if desired, on the outstanding accounts receivable as a sales expense. (See page 112.)

it is not necessary to reckon fixed charges on different classes of the business) or to the very simplest manufacturing conditions. According to this method, interest charged to cost or expense¹ will be divided between interest on borrowed money and interest on capital owned. The interest on borrowed money is interest on bonds, notes and accounts payable. Interest on capital owned, **as a charge complementary to interest on borrowed money**, is reckoned on the "net investment" in the business, that is, on the difference between the sum of the assets—cash, notes and accounts receivable, raw materials, work-in-process and finished goods inventories, prepaid interest, insurance, etc., and the sum of all the liabilities—notes and accounts payable and all accrued items. (The reader will note the omission of plant and equipment assets. See page 108.

¹ In a discussion of principles, it seems clearer to avoid the constant repetition of alternative phrases. The reader will, therefore, understand that where reference is made to interest "charged to cost" it will usually mean cost to manufacture. As to merchandise inventories carried for trading only, the fact would be expressed as interest "charged to expense." This is the phrase which is generally used in discussions of the "net investment" method, chiefly for the reason that this method has been described in connection with uniform accounting plans for merchandise or trading establishments rather than for factories.

When this second method is used, the charge to cost will come in two parts: First, as interest is reckoned and paid for borrowed money; and second, an amount by a journal entry, reckoning at the agreed-upon rate of interest on the net investment as above defined. The interest on the borrowed money will be a cash disbursement, when the interest is paid; the second part of the entry will be carried, as in the first method, as a credit to an income account known as Interest Charged to Cost.

A theoretical objection to reckoning the interest charge to cost in two parts in this way is that it involves the use of two rates, one of which is bound to fluctuate from time to time, as the current market rate for business paper goes up or down. This introduces a variable element into the calculation which is objectionable, particularly when uniformity is sought in accounting for an entire industry, as two business enterprises, otherwise substantially alike, may be financed so differently that one will have much of its interest charge derived from borrowed money, and the other will have none from that source, but all the interest cost reckoned as a rate on the investment. It is fundamentally correct to say that "the dollar owned does just as much work and should be compensated

as is the dollar borrowed," but since that is true, they should be compensated *alike* when used in the same business. As that is impossible according to the "net investment" method (with one or more rates on borrowed money, and the agreed-upon and probably entirely different rate on the net investment), it seems that that method should be abandoned in favor of one that does not involve such inconsistency.

Another very serious objection to this "net investment" method, even within the limited field in which it can possibly be applied, is that it can rarely be used unmodified. In the Harvard System of Accounts for Shoe Wholesalers, published in the summer of 1916, there is the most authoritative exposition of this method known to the author, and there the reader will find that interest on land and buildings is specifically excluded from the "net investment" calculation, for the good and sufficient reason that it is a charge to a Rent account, which must be set up *completely*, and *independently of other expenses*, if any comparison is to be made between businesses which operate in premises owned and businesses which operate in premises rented. This difficulty would be very much more serious in a manufacturing establishment, where interest on the investment must be

reckoned for the equipment,¹ usually in several different subdivisions, and on three, or perhaps four, different kinds of inventories.

Even in a merchandising business, such as wholesaling shoes, the plan as defined breaks down (to the extent that further exceptions must be made) if the proprietors are interested to get an accurate measure of the results between selling shoes, for example, and rubber goods, which most of these establishments also handle. In a business like wholesale hardware it would be indispensable to reckon fixed charges on inventories by classes, in order to measure the results in a satisfactory way. Whenever fixed charges require any considerable division the "net investment" plan breaks down completely.

Whenever an attempt is made to use this method *attention should be fixed on the sum of the two charges*, namely, interest on borrowed money and interest on capital owned. If the business operates with extensive borrowing, the interest charge on that account will be large. If the owners have provided most of the capital, most of the amount charged into cost will be credited to the account, Interest Charged to Cost, and then to Loss and Gain. (See page 105.)

¹ See parenthesis, page 106.

Interest on Accounts Receivable

There is one marked theoretical advantage that can be claimed for the "net investment" method, and that is that it takes into account the investment which the business may have in accounts receivable, and also the temporary credit which it has through accounts payable.

There is undoubtedly an interest cost for carrying open accounts, as well as a credit risk. This interest cost will be larger for a miscellaneous jobbing business, with its fairly long credits, than for a packing house which ordinarily requires weekly settlements. It will be reduced to nothing, and both carrying charges and credit risks will be entirely eliminated, in a mail order business where ordinarily remittances in full are required of customers in advance of shipment. Every banker knows that the requirements of different lines of trade vary widely in respect to terms allowed to customers on accounts receivable, and in the lines where credits are long, a large investment is required to carry the customers. Some rather striking results have been disclosed to managers when keen-witted accountants have reckoned up the relation between big customers' balances and interest on borrowed money.¹

¹ This problem is very similar to that in a bank, which makes

It is a well-known fact that many business establishments that are short of capital stretch their credit to the limit in handling accounts payable.

In considering the cost of carrying accounts receivable, it must be noted that, except for certain kinds of taxation, the only charge is for interest on the investment. Accounts receivable are sometimes insured, it is true, and when this is the case, the company then has a definite and entirely distinct charge to selling expense on this account (instead of, or in addition to credit losses).

Since it is customary to regard interest on the investment as the only fixed charge of carrying accounts receivable, and since there is rarely any cost accounting involved (of the kind that is the chief reason for reckoning interest on investment as an element of the cost of manufacturing) the view is held by some, who otherwise agree with the author, that any interest calculations in respect to accounts receivable, or accounts payable, are purely a matter of financing, "a function of the treasury department," as it is sometimes expressed. According to this conception of the matter, the treasury department takes charge of the

a careful analysis of the cost of different customers' accounts, considering the time required for the collection of distant checks, etc.

finances of a business, and should properly assess the cost of capital used against the manufacturing department, and in some cases the sales department, but does not need to assess the capital cost against its own operations, which are said to be in capital only.

It seems to the author that this distinction is not altogether sustained in respect to accounts receivable, and where an interest charge on accounts receivable is a matter of any particular consequence to a business, it seems logical to reckon it, as on other invested assets. As a practical matter¹ it can usually be ignored, however. That would be the author's recommendation uniformly in respect to interest on the temporary credit of accounts payable, although there can be no particular objection to making the calculation. Some proprietors, who are better accountants than they are managers, might like to figure up the credit as an offset to the neglected discounts, which would undoubtedly accumulate under conditions of that kind.

Interest on Bank Balances

After the capital cost of carrying all other assets has been reckoned (and under the "net invest-

¹ See footnote, page 105.

ment" plan an allowance made for the temporary credit of accounts payable) there remains to be considered the investment a business has in bank balances.

Here we have the financial department pure and simple. It is not a manufacturing cost, and it is not a sales expense, and yet the policy of carrying liberal bank accounts involves a greater immediate capital cost to the proprietors than would be the case if meager bank balances were carried.

It is logical enough to reckon interest on accounts receivable. This cost has already been referred to as a sales expense (see footnote, page 105), as it seems entirely analogous to credit losses. Inventories of finished goods carried as a sales policy might also be considered a sales expense,¹ but larger or smaller bank balances are purely a matter of finance, and there seems to be little or nothing gained by reckoning interest on the invested balances.

The "net investment" method does, in effect, reckon interest on bank balances, as they are one of the conspicuous items among the current assets. It seems to the author, therefore, that all that the "net investment" method gains theoretically by the treatment which it accords to accounts

¹ See page 95.

receivable and accounts payable, it loses by the calculation of interest on bank balances, which is unnecessary to say the least.

SOME OBJECTIONS ANSWERED

It seems highly significant that the opinion is practically unanimous among professional *cost* accountants in the United States to include interest on investment in manufacturing cost. Some distinguished accountants, however, especially those of the British school, are on record in opposition. An article by Mr. A. Lowes Dickinson, published in the *Journal of Accountancy* in August, 1913, is probably the ablest statement of the view that interest on investment is not properly an element of manufacturing cost. Mr. Dickinson presents the same views in his well known book, "Accounting Practice and Procedure."

Interest and Rent

By the same reasoning that supports this view, Mr. Dickinson reaches the conclusion that rent also should be excluded from manufacturing cost. This opinion will probably be condemned without discussion by any business man who has realized the stern necessity of paying the rent in order to

continue his manufacturing or other business operations. (See Addendum, p. 313.)

Some emphasis on the landlord's function, in fact, is pretty certain to convince a manufacturer that he has not reckoned on the whole cost of his operations until he has set up the accounting equivalent to what his landlord would have, if the manufacturing operations were being carried on in rented buildings, or with leased machinery.

The landlord has to pay insurance, taxes and repairs, unless these charges are assumed by a tenant as part of the terms of the lease. He must incur the loss of depreciation. Even the most liberal repairs will not entirely check the deterioration and obsolescence of a structure. It may serve well for a generation or longer, but the time surely comes when, because of structural weakness or the superiority of modern design or a better location, it cannot be used economically. This lack of fitness is essentially a landlord's risk.

The landlord expects, if possible, to charge as rent enough to make his property pay a fair return on the investment. This charge against operations certainly does not in any way diminish if the property changes hands from A to B. The new owner will also exact a rent to make his income a fair return on the investment. Neither

the first nor second owner would think of a *profit* as a real estate operator until so much had been provided for.

If the title passes, in course of time, to the man who has heretofore been the tenant, does it *cost* him any less (in any sense—either practically or as an economic theory) to make shoes or shirts, furniture or machinery, in that building, because he now owns it? It is true that he no longer pays in cash the landlord's charge, but can anyone contend that his product is manufactured cheaper than before? The present writer believes the answer to be a self-evident negative.

Alleged Difficulty Regarding the Rate

Another objection in the article referred to is the difficulty of deciding as to the rate that should be used, but it seems to the writer that the argument at this point and elsewhere would speedily lead to a conclusion and agreement if we could be rid of the confusion between interest and profit.

The rate of dividend that a corporation may have declared or earned certainly should not influence in the remotest way the rate of interest to be charged on investment for the purpose of determining costs. A corporation may be overcapitalized or undercapitalized, and either of these

facts will permanently influence its dividend rate, which may also vary widely from year to year, according to the prosperity of the business.

Neither should the rate of interest on the preferred stock or bonded debt of the company be a determining factor. The "effective rate" on an industrial bond or stock issue is a composite result of security of principal and income, and marketability. These factors may in turn depend upon the age, character, or even the reputation of the particular establishment, or the industry.

There will be no great difference of opinion among well informed people as to what is a fair investor's rate with proper security for principal and income and reasonable marketability. The Harvard Bureau of Business Research recommends the use of "the ordinary interest rate on reasonably secured long term investment, in the locality in which the business is situated. In measuring the result of his business, as has already been pointed out, the business man, if he thinks about the subject at all, computes the amount of interest which his capital would earn, if he invested it in something else. The Bureau has determined from its inquiries that there seems to be in each locality a definite idea as to what constitutes a current rate of interest."

In answer to the objection that rates of interest vary between localities, the Harvard Bureau says truly that "the fact that interest rates vary is not a valid reason for not including interest in the expense statement. The rates of wages vary, rent varies. . . ." In respect to a manufacturing enterprise, it might also be pointed out that the cost of raw material varies according to the different sources of supply and transportation facilities.

As to the validity of an interest rate to be used in cost accounting, nothing more is required than that it should be reasonable and *agreed upon* by the persons concerned.

When it has been agreed upon, it certainly takes on a very real meaning, as the author has repeatedly observed when manufacturers are trying to discuss in common terms the cost of their product and a reasonable selling price therefor. Manufacturers repeatedly think in terms of interest on their invested capital as a legitimate part of their selling price, and they can be greatly helped to know what a fair price is by knowing first their manufacturing costs.

How Business Men Regard Interest on Investment

The most recent article, and one of the most technical and scholarly that has ever appeared in

opposition to the inclusion of interest on investment as a charge to cost is that by Mr. George O. May, C. P. A., in the *Journal of Accountancy* for June, 1916. Mr. May's article is given over chiefly to a discussion of the rate that shall be used. He recognizes three alternatives, namely:

1. "A rate equal to that yielded by the safest investments."
2. "A rate equal to that at which money can be borrowed for the particular industry."
3. "A rate sufficient to attract permanent investment into the industry."

It is something of a surprise to the author to have Mr. May say, "of the three alternatives, the second is probably the most generally favored, and it will, therefore, be assumed as the basis for the following discussion." The article then proceeds to demolish the argument on behalf of using a rate equal to that at which money can be borrowed for the particular industry.

There are many statements in the article with which the author cordially agrees, but it seems that there is a fallacy in the argument that is built up with these statements, because they rest on certain fundamentally wrong premises. For example, one must agree with Mr. May when he says "there is no sense or advantage in including in cost in-

terest on investment in fixed assets, unless interest on investment in current assets employed in manufacture is also considered," but one must disagree emphatically with the statement which immediately follows that an "attempt to introduce correctly computed interest allowances on both classes of investments involves difficulties out of all proportion to any possible benefit." There is certainly no difficulty worth mentioning in calculating any agreed-upon rate. The argument must, therefore, come as to the significance of the words "correctly computed" interest, and obviously whether a given rate is or is not correctly computed depends on the meaning which the selected rate is intended to have.

One must also disagree emphatically with the statement that despite the "theoretical ground for the claim that interest on some logical basis can be included in cost, it is not worth while in practice to attempt to do it." The fact seems rather to be that the practical advantages are so important that it is worth while even if it were necessary to sacrifice some theoretical perfection to attain them.

The principal argument in Mr. May's excellent article is based on what the present author believes to be a confusion between the returns on capital

and the returns to the proprietor for his skill or risk. It is a mistake to refer, as Mr. May does, to "compensation of the proprietor's capital." Those who have followed the author's argument so far, will agree that the returns for the proprietor's *capital* can be reckoned by other standards with considerable accuracy, and whatever else he gets is a return for something besides capital. This view seems to be conclusively sustained by the economists quoted in the Appendix, page 299.

Mr. May's views and those of the author are squarely in opposition when he objects to the "pure interest basis, because it provides compensation only for the use of money, but not for the risk to which it is subjected," and insists that "the risk is by far the more important element."

The author finds himself obliged to disagree with Mr. May in one final important particular when he says "the rate which will attract capital into an industry would seem to be one of the things which accounts should help to determine, rather than anything which could be assumed as an element of cost." The first part of the statement is true enough, but the rate which will prove attractive in a given industry can be determined with even greater clearness by charging interest into cost than by leaving it out.

If the attention of prospective investors is fixed on the probable rate of return on capital embarked in a particular enterprise, it seems certain that they will make a comparison between the conventional investors' rate and the amount that they can expect to earn from the investment in question, or, in other words, *how much better they can do in the new industry* than with their capital invested as it is. In a continuous process industry, like the making of flour, cement, brick, pig iron, or sulphite pulp, it makes but little practical difference whether the desired information is read from two entries or from one, but in any ordinary complex industry, the practical considerations make it imperative that the interest-charged-to-cost method should be adopted.

When reference is made to "that rate which will attract capital into an industry," the reasoning is that capital return is a residuum, or a residual element. The author believes that this theory is incorrect in principle, and that it finds no practical support among business men. The fact seems to be rather that business men regard a safe rate of interest on their capital as the cost of doing business, and are interested chiefly to see how much more than that they can earn as a reward for their skill and the risk they take.

Inflated Inventories

The most serious objection to reckoning interest into cost, in the opinion of some accountants, is that to do so "inflates" the value of an inventory. The debate arises over the word *inflate*, for there can be no doubt that, so far as a calculation of interest on investment increases cost, it logically raises the price at which manufactured goods are carried in an inventory.

To the present writer this seems no objection at all. Everyone admits that seasoned lumber is worth more than green timber. Certain other commodities, such as paper, wines and leaf tobacco, are more valuable when properly "aged." The cost of this aging process on articles of any description is almost exclusively a capital cost of carrying the investment to maturity. In such instances there seems to be no escape from this logic of "cost to carry," *and a greater resulting value.*

With reference to the cost of carrying inventories, it should be clearly understood by those who wish to examine the argument closely, that to insist that interest on the investment is part of the cost of carrying *does not depend on the argument of an increased value at the end of a period of time.* In some cases, as with seasoned lumber, there is an increased value because of a time element, but

whether the cost of carrying inventories is an expense or an asset, is a matter of fact and not of theory.

But the cost to carry is also a fact and cannot be avoided. If the volume of raw material and work-in-process carried is well proportioned to the needs of the business, the cost of carrying it is an entirely appropriate part of manufacturing costs and should be recognized in pricing the inventory of finished goods, just as one would include the cost of material well purchased in the first place, or the cost of labor economically employed in its conversion.

If the kind of material purchased, however, was unnecessarily expensive for the product, or if the labor in its manufacture has been wastefully used, or if (to revert to the point which is of interest in this connection) there has been a serious error of management in carrying badly selected or excessive manufacturing inventories (raw material or work-in-process) a conservative view of the product may be that it is not worth what it has cost. This, however, is a matter of value, and not of cost.

Now any inventory of manufactured goods has used capital, frequently in huge quantities, in the process of conversion from raw material to fin-

ished product. It has also used capital in the possession of the producer before coming to the manufacturer, and the purchase price to him is higher accordingly. If it has used capital it therefore has, indisputably, a greater cost. If the manufacturing business has been sensibly managed, the product is worth what it has cost in capital in its last stage (manufacturing), just as much as in any previous (producing) stage. To be specific, the capital cost of converting rags to paper is just as inevitably an addition to its cost, and just as fair an addition to its inventory price, as the cost of seasoning or "loft drying" the paper. Again, the capital cost of converting seasoned lumber into furniture is just as inevitably an addition to its cost, and just as fair an addition to its inventory price, as the cost of seasoning it beforehand.

In short, it takes capital to manufacture—more or less capital according to the kind of product made, and according to the manufacturing policy pursued. Frequently a liberal use of capital diminishes other costs, and the too meager use of capital increases other costs. Interest on investment is the conventional and logical way of expressing capital cost. Why isn't one kind of a cost as good an addition to value as another?

There is, therefore, no reason why an inventory should not be carried **at all its cost**, including so much thereof as may be due to interest on the investment employed.

While we are on the subject of inventory values, let us consider how trivial in comparison with some real inventory weaknesses is any possibility of "inflated" costs because of a calculation of interest on the investment. Accountants of high standing who object to reckoning interest on investment are known to the writer to have passed with approval inventories in which goods were taken higher than in the preceding annual inventory, because, forsooth, **with a curtailed volume** they "cost more to make" during the later year than during the earlier. In this proceeding we have an expense which is not in any proper sense cost-to-manufacture blithely added to inventory values "at cost."¹

¹ Situations like this reveal most conclusively the fallacy of the old-fashioned plans of charging all burden into cost, or if a normal burden is first calculated, the mistake of adding a "supplementary rate." If the product of a plant is sold as fast as it is manufactured, there is no difference in the *net profit*, according to one plan or the other, but if inventories are changing in volume, there will be a very real inflation of profits and assets with an increasing inventory, and a very poor and unreal showing of profits per volume of sales during a period of diminishing inventories.

Auditors not skilled and experienced in industrial accounting certainly encounter difficulties in trying to decide on the significance and sufficiency of much that passes for cost accounting. The errors of this kind, committed in good faith but in blissful ignorance of realities, are likely to far outweigh any possible overvaluation resulting from debatable elements in a scientifically calculated cost.

Let no one infer from these remarks that the writer underestimates the importance of being conservative in valuing inventories. Accountants should strive zealously to see that items or values that do not belong in the inventory are excluded. There may be many considerations to influence a price below cost on inventory items, or a liberal reserve against the total, or important sections, of the inventory. If there are good reasons for such action in a given case, by all means observe them consistently, but if cost is the basis, by all means get it *all* in.

Anticipated Profits

In the articles which have appeared from time to time in the *Journal of Accountancy* in opposition to the inclusion of interest on investment in manufacturing costs, the argument has been made

that to charge interest into cost anticipates profits. This result can be accomplished only by overvaluing the inventory, and it is believed by the author that this idea of overvaluation has been completely demolished in the preceding paragraphs. Those who share this view will agree with the opinion that there is no anticipation of profits in an inventory which is priced at a cost which has been built up by including interest at a fair rate on the investment used in its manufacture.

All accountants will agree that it is highly desirable, for a correct view of profits, that the inventories be priced correctly, especially so if there are fluctuations in the volume of inventory from one closing to another. If the custom is to overvalue inventories,¹ profits are obviously overstated in periods when inventories accumulate, and understated in periods when stocks are diminished. If it is the practice to undervalue the inventories, just the reverse effect is produced.

If it is desired to have the inventory conservatively stated in total, it seems altogether better to make a suitable reserve to accomplish that result, rather than to leave out essential and calculable elements in the cost.

¹ See footnote, page 126.

Interest on Borrowed Money

In discussing interest on investment as an element of cost, it should be unnecessary to point out that we are not in any way concerned with interest paid on borrowed money (whether bonds or notes payable).

Interest on borrowed money, whether on current notes payable or bonded debt, is simply a payment to creditors for capital loaned. If there were no borrowing of either kind, there would be no charges for interest disbursement, and, while under these circumstances the company would have more money to divide as dividends, it would only be because the capital had been provided by stockholders, instead of by bondholders or bankers. The cost of manufacturing is obviously neither more nor less because the plant has a larger or a smaller capital contribution from its owners.

Unfortunately, many manufacturers are inclined to assess the cost of some special borrowing on the operations that occasion that borrowing. The most common example is that of borrowing to carry larger inventories of finished goods, rather than to incur the losses of shutting down a plant. There can be no doubt that carrying larger inventories of any kind is an increased cost to the

proprietors, *but no more so because the business has to borrow to carry out this program.*

Some Other Objections

Some writers seem to have a curiously confused idea that Interest-on-Investment as a charge to cost is in some way related to the subject of depreciation, so that a proper provision for depreciation obviates the necessity of charging interest on the investment. Depreciation is the cost of wasting or exhausting an asset. If the asset in question were perpetually self-renewing so that no depreciation occurred, or had to be provided for, the charge for interest cost on capital used would be none the less, and the arguments therefor, as brought forth in this chapter and by other writers who share the author's view, would not be one whit changed by eliminating entirely all consideration of depreciation.

Land when used for industrial purposes, is a perfect illustration of this argument. It does not depreciate in the ordinary sense of the word, and yet the interest charged on the investment in land is an unavoidable factor to be reckoned with in getting correct costs.

Another error into which the opponents of the interest charge seem to fall very easily, is to in-

fer that interest is an indirect cost, whereas with a proper burden distribution, it becomes almost as direct and exact as labor and material themselves.

In the article by Mr. Dickinson, above referred to, the admission is made that there is a demand, or even a necessity for some more information than would naturally be provided in regard to cost, if interest on the investment is omitted from the calculations. This demand it is proposed to meet by certain "supplementary statistical accounting."

The author would certainly deem it a pleasure to see anything of the kind in successful operation. It may well be that the accomplished comptroller of some huge industrial corporation is in the habit of making precise calculations involving the exact use of economic theories, entirely apart from straightforward double entry bookkeeping, which can be practically applied and made to serve every need for information which arises in this connection. From a fairly broad experience with constructive accounting in a wide variety of industries, the author ventures to doubt whether an attempt of this kind could be expected to succeed with the ordinary manufacturer or his overworked chief accountant.

What the Manufacturer Wants

What the manufacturer wants for his own information and what he expects his accounting staff and system to provide, is dependable information as to the inclusive cost of what he makes to sell. He is interested in getting a profit out of his business and, if possible, selling each individual article at a satisfactory margin over manufacturing cost.¹ It seems like the A B C of management to say that in order to do this he must first know what each article costs when it is in the shipping room ready for delivery to the customer, and so far as this cost is made up from the use of capital, it should certainly be expressed with unvarying consistency as interest on investment charged to cost.

The manufacturer may not be interested in the mechanism, or accounting practice or procedure, by which this result is accomplished, but the accountants who are responsible for the design, installation and successful operation of systems calculated to produce this information, have long since learned to avoid the snares and pitfalls of supplementary and detached records, and tie the whole chain of information solidly into the general accounting.

This view of coördinating general and factory

¹ See pages 8, 16, 118.

accounting will no doubt be agreed to by nearly every practicing accountant in the United States, and since it can be applied so easily and so effectively to interest on the investment as well as to all the other elements of burden, and since, as the author has pointed out, there are so many reasons for including interest with the other calculations, and none that will stand the test of analysis for not doing so, it is to be hoped that a greater number of accountants will in this respect progress in practical service to their employers or clients who want to know the facts.

CHAPTER VIII

RENT AND EQUIPMENT CHARGES

Elements of the Rent Charge

In case a manufacturer rents his plant from a landlord, the rent chargeable to each department can be easily determined by apportioning the total rental paid and additional charges for heat and light among the departments in proportion to the relative areas which they occupy. In most cases, however, the manufacturer owns his own plant and must meet several different expenses, which in total make up an item corresponding to rent. To illustrate: Suppose that a manufacturing plant is located on a piece of land worth \$40,000. The enterprise has at once absorbed capital that should earn about \$2,000 a year to the ordinary prudent investor who takes no manufacturing or trading risks. A site as costly as this is probably subject to taxes of \$500 or \$600. These expenses for interest and taxes on land are the first of the several items, equivalent to rent, which a manufacturer must pay for the use of his own plant.

Assume that shop buildings have been erected at a cost of \$200,000. This outlay of capital, like the investment in land, involves an annual interest charge of \$10,000, and some thousands of dollars more for taxes. Unlike land, the buildings will also require constant repairs, and are subject to a slow but certain deterioration that must be met by a charge for depreciation. To protect the investment, the owners must insure the property and provide watchmen. To make the buildings usable, they must be heated, lighted, ventilated, supplied with water and cleaned regularly. The striking thing about these charges is that they all go on without any abatement, unless the shop is shut down dark and cold, and even then the principal charges, interest, taxes, insurance, depreciation and repairs, abate scarcely at all.

Distribution of Rent Charges

All this expense has been incurred by the management to provide suitable shelter for the intended manufacturing processes. If there are twenty production centers, each one may occupy an entire small building, or all or part of a floor in a larger building. Whatever the actual circumstances, each production center uses a certain number of square feet of floor space and must carry

its proportionate share of the rent charge, which is made up of the above expenses.

The first step in the determination of the proper square foot charges in a particular plant, is to calculate the interest and tax charges on the investment in used land, using the rates for interest and taxes which have been determined in accordance with the methods described in the previous chapters. These fixed charges on the land should be distributed to the buildings in proportion to the relative areas of land which they occupy.

Having determined the proper land charge against each building, the next element of the rent expense is the fixed charges on the buildings themselves. Charges for interest, taxes and insurance based on the appraisal value of the buildings should be calculated, using the rates of fixed charges previously determined for these expenses. The proper depreciation charge will depend upon the type of each building. In addition to the value of a building itself, there are certain fixtures in every building, such as the sprinkler,¹ heating and

¹ If there is sufficient reason for being so precise in burden calculations, fixed charges on the sprinkler system, water tank, or any other fire protection equipment, is, strictly speaking, part of the insurance charge, and should be distributed in the same way as the net cost of premiums paid to the insurance companies. In a large plant with scattered buildings, costs

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gas or electric lighting systems, which are practically a part of the building, and the fixed charges on these fixtures should also be calculated and included in the rent cost.

Proper charges for heat and light should be determined in connection with the distribution of power costs, which will be discussed more fully in a later chapter. A calculation should be made as to the proper charge to each building for this service. Other expenses such as janitor service, and the expenditures for watchmen and cleaning should be distributed to buildings in accordance with the duties of the employees engaged in this kind of work.

After all of these expenses have been grouped by buildings, they should be totaled,¹ to give the total rent charge for each building. This rent charge for a particular building, divided by the available area in that building, gives a rate per square foot which represents the annual cost of maintaining floor space in it.

of this kind may vary according to the fire protection provisions in different buildings, and make a small, although appreciable variation in the burden.

¹The actual use of light and heat may vary enough in different parts of the same building to justify calculations for the purpose of distributing these charges actually as incurred rather than as part of a general rent charge.

Unused Land and Buildings

In addition to the direct advantage of knowing the proper rental charge to each production center, there are other advantages resulting from this analysis of rental expenses. It is frequently the case that when a manufacturing plant is established, more land will be purchased than is immediately necessary, in order to allow for the expected expansion of the business. In this event, only the interest and taxes on that portion of the land which is used should be charged to cost. The fixed charges on unused land should be considered an investment expense and charged directly to Loss and Gain.

The same theory holds true in connection with unused space in buildings. After the cost of maintaining floor space per square foot has been determined for a building, it may be found in distributing rent charges that a certain portion of the building is unused. In this event, the expense of maintaining this unused space should be charged direct to Loss and Gain, and not added to the rent charged to departments which occupy the rest of the building. As soon as this unused space is utilized by the installation of additional productions centers, or expanding centers already operating, the proper rental charge can be made to

these centers. In this way, the rental charge to the production centers already installed will not be affected and a correct cost will have been in use all of the time.

Rented Space

A careful determination of the actual costs equivalent to rent sometimes brings out some surprising results aside from the information which it was originally intended to secure. It is frequently the case that a manufacturer, finding that he has some available space, will rent to a tenant. Assuming that the space is valuable from a manufacturing point of view, the manufacturer should certainly receive as rent the full cost of maintaining the floor space and possibly some profit. In several instances it has been found that the rent received from a tenant covered the cost of taxes, insurance and a reasonable allowance for depreciation and repairs, but that when interest at the rate of 5 per cent on the investment was included in cost, which expense had not been considered previously, the rental received was not enough. In other words, the manufacturer who had put up the capital necessary to provide the building space was receiving practically no return on this investment.

Determination of Production Centers

Let us now consider that we have a factory with the production centers clearly indicated and with the cost of the floor space used by each properly determined. The department and production center divisions are not necessarily in accordance with physical partitions in the factory, nor need they necessarily be by individual machines. For example, within one department, as defined by physical partitions, there may be several different operations performed, such as milling, boring, and grinding, and each will be a production center.

In a large shop there will be several milling machines of the same size. This means that each will occupy approximately the same amount of floor space, that the investment in each will be about the same, the power required will not vary appreciably, and the work assigned to these machines will be routed to any one of them, depending upon which is available. Under these circumstances the entire group should be considered as one production center, and a machine rate per hour for milling should be determined.

On the other hand, there may be considerable latitude to the size of the milling operations which have to be performed, necessitating machines of widely differing capacity. In this event, there

should be at least two rates for milling, one for heavy and one for light work, and in developing burden charges, each group should be considered a separate production center.

Elements of Equipment Charges

Each production center is provided with the equipment necessary for the manufacturing operations which it must perform. The charges for interest, taxes, insurance and depreciation on the investment in each production center are based on the value of this equipment.

Before attempting to calculate these fixed charges, the complete investment necessary for the operation of a production center should be determined. The valuation of a machine tool, or group of similar machine tools, does not alone represent the investment in a production center. For example, two or three motors, varying in size according to the amount of power used, may be required to drive a group of machines making up a production center. It may be necessary to invest in shafting, pulleys and belting in order to transmit the power from the motors to the machines. Depending on the nature of the operations to be performed, there will be some investment in small tools to be used on particular classes of machines.

This investment should be classified in accordance with production centers. There is a large amount of sundry equipment to be found in every plant which has a value sufficient to warrant its being included in the plant appraisal, and this should also be taken into consideration in determining the total investment by production centers.

This analysis of machinery and equipment values by production centers is much more important than it might seem at first. In actual practice, it will be found that the value of a machine tool itself frequently represents an insignificant part of the total equipment value of a production center. For example, a drill, a press, or a punch, on which it is planned to perform special operations, may be equipped with dies, jigs and fixtures which far exceed the value of the machine itself. Some departments may be arranged with individual motor drives for machinery, whereas the machinery in other departments may be driven from a main shaft, which is in turn driven by one large motor. With individual motor drives, the investment per machine in power and transmission equipment is likely to be considerably greater than with other types of power installation, although corresponding economies in operating charges may be secured to offset this cost. (This is a good illustration of

capital cost offsetting operating cost.) A true division of fixed charges on investment can only be secured, however, by making a proper distribution of all equipment to the production centers and calculating the fixed charges on the investment in each.

Calculation of Equipment Charges

After this distribution of appraisal values has been completed, the fixed charges on the equipment in each production center may be calculated by using the rates for interest, taxes, insurance and depreciation which have been derived as explained in the preceding chapter. The rates for interest, taxes and insurance will presumably be the same per dollar of investment on all kinds of equipment. The rate for depreciation will vary, however, in accordance with the nature of the equipment.

Summarizing these charges after they have been calculated, gives the total fixed charge on equipment against each production center. These fixed charges on equipment in a particular center, plus the rent charges already discussed, make up the total fixed charges in that production center, which must be met whether the plant is operating or idle.

CHAPTER IX

REPAIRS, INDIRECT LABOR AND SUPPLIES

The preceding chapter was devoted to a discussion of rent and equipment charges which are fixed elements of burden. In addition to fixed charges, there are several operating charges which are incurred as soon as production is commenced. In this chapter, the three elements of repairs, indirect labor and supplies will be considered.

Repairs may be regarded as a fixed charge, either independently, or combined with depreciation as discussed in Chapter VI. When repairs are regarded as a fixed charge that theory will be given effect by charging to the designated burden account a predetermined fixed amount allowed for repairs, and a corresponding credit made to a reserve account. The repairs when actually incurred will then be charged against the reserve account.¹

¹ Practically the same result is secured when a burden rate is fixed to include repairs for a standard or scheduled amount. The repair charges will naturally vary somewhat from the estimates, running over the estimate part of the time, and running under the estimate part of the time. The bookkeeping

In reading this chapter, particularly the paragraphs relating to repairs and supplies, it should be borne clearly in mind that we are here concerned with *forecasts* of operating costs. How to collect these costs actually has been explained in considerable detail in the earlier chapters of this volume dealing with labor and material distributions.

Repair Cost Determination

There are two distinct steps in the determination of proper repair charges. First, the determination of the total probable cost of repairs from a consideration of the different expenses going to make up this cost, and, second, the proper distribution of this total expense to the buildings, machinery and equipment which must be kept in repair.

Every manufacturing plant of any appreciable size has a repair or maintenance department. It is usually the case that this department not only attends to repair work, but to new construction about the plant which is not of sufficient impor-

details are different, but the principle is exactly the same as operating a reserve account. In one case the reserve is separate, and in the other case it is part of burden variance (as described in Chapter XIII), and will there be combined with other variables in a departmental burden account.

tance to warrant the introduction of outside contractors. A calculation of the annual cost of operating this department with due allowance for the cost of new construction, will indicate the total probable cost of repairs.

There will be an annual payroll expenditure in the repair department and an annual consumption of materials used on this work. There will also be an overhead expense consisting of rent, or equivalent charges for the amount of space used, fixed charges on the equipment in the repair department, power required for the operation of its machine tools, general supervision by the plant engineer, or master mechanic, and the expense for a certain amount of supplies used. This burden can be determined in a manner exactly parallel to that by which the burden for any manufacturing department is determined.

The cost of repair work done by company's employees should include not only direct labor and material, but also the burden of the repair department. Only in this manner can the cost of work done by the repair department be placed on a fair comparative basis with work which might be done by outside contractors.

What is more important, it is only by adding burden to repair work that an adequate charge is

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secured to a department for its repairs, which is one of the most important variable elements in the departmental burden. If repairs are reckoned correctly (to include repair burden) there are necessarily larger totals to watch and control. It is like using a magnifying glass; it makes details clearer and of value for themselves rather than merely as part of a total. Furthermore, if repair burden is added to repair orders, it effects an actual distribution of repair shop overhead charges, which would otherwise remain to be distributed as part of general burden on some more or less arbitrary basis, certainly not related in any definite way to repair work.

Repair Cost Distribution

The next and final step preliminary to estimating repair costs is to make a proper distribution of the total, developed as explained in the preceding paragraphs, to buildings and equipment of all kinds.

For this purpose, the buildings, machinery, and equipment should be classified into logical groups on which a similar expense for repairs might be expected. There is a logical broad division between buildings and equipment. It is sometimes advisable to group buildings according to construc-

tion, for example, wood, brick, concrete and steel. Similarly, machinery and equipment should be divided into such classes as machine tools, power plant equipment, transmission equipment, small tools, shop furniture and other sundry equipment.

Reference should be made to any existing shop records indicating the general distribution of the repair department expense over these several kinds of assets. The final result should be the determination of a percentage of the value of each class of buildings and equipment which it will be necessary to spend in the course of a year, in order to maintain them in a proper state of repair. When these percentages have been determined, the repairs chargeable to each building, or chargeable to each production center for its equipment, can be calculated by applying the percentage to the value of the building or equipment under consideration. Repair costs estimated in this manner and subsequently checked by actual repair costs, give an accurate and satisfactory determination of the amount of this expense.

Indirect Labor

The first broad division between direct and indirect labor is secured by separating the payroll

of the manufacturing departments from that of the departments which are auxiliary to manufacturing, such as the power plant and the stores, shipping, cost, and planning departments. The indirect labor in these auxiliary departments should not be redistributed directly over the manufacturing departments, but should be charged to the cost of operating the auxiliary departments, and ultimately disposed of in accordance with the proper distribution of their total expense of operation. For example, the power plant payroll should be charged to production centers only as a part of the cost of power per horse-power hour. Previous to making this charge the power plant payroll should have been combined with other operating and fixed charges in the power plant, resulting in the determination of the cost of power per horse-power hour.

After this broad division between manufacturing and auxiliary departments has been made, attention should be turned to the manufacturing departments. Both direct and indirect labor will be found in these departments, and it is necessary that an analysis of the payroll be made, separating the expense of foreman, shop clerks, helpers, truckers, sweepers, etc., from that of the men who are directly engaged in turning out product and

whose time can be charged as a direct labor cost to order numbers.

The expense of indirect labor so determined should next be distributed to production centers. A careful distribution of this expense is obtained by considering each class of indirect labor separately. The time of foremen and shop clerks, for example, bears considerable relation to the number of employees under their supervision, and it is most frequently correct to make the distribution on this basis. The expense of truckers and helpers can usually be distributed by a consideration of the amount of product which is handled by the several production centers and from a knowledge of those operations which require a helper in frequent attendance. The expense of sweepers is fairly divisible in proportion to the relative floor areas which the production centers occupy.

Thus, by making an analysis of the different kinds of indirect labor, distributing each separately to production centers, and adding the results, a fair estimate as to the proper indirect labor charge against each is determined.

Supplies

In estimating the cost of factory supplies, a careful review should be made of all classes of

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materials and supplies purchased. In general, there are four classes of purchases. First, those materials which become a direct part of the finished product and which can be charged to order numbers when issued from stores. Second, those materials which become a part of the finished product, but which, because of their nature, cannot be directly charged to manufacturing order numbers as issued from stores; for example, paint, lacquer, plating and insulating materials, nuts, screws, bolts, etc. Such materials are usually charged to cost at scheduled rates, based on predetermined tests and estimates.

The third division includes materials used largely by the maintenance department for new construction and repair work, such as building material, shafting, belting, and repair parts for machinery and similar purchases. The fourth general division will include the factory supplies which are not chargeable to the product made, to the plant account for new construction, or to the material cost of current repair work. This fourth group of purchases makes up the item Supplies which must be handled as an element of factory burden.

For the purpose of establishing a scheduled burden charge for supplies in each department,

the annual cost of the supplies consumed should first be calculated from existing records. The nature of the supplies will usually indicate at least a proper departmental distribution, and an approximate further distribution should next be made to production centers. For example, coal, boiler compound, and certain grades of oil will be chargeable to the power plant. If there is a drop forge department, there will be supplies, such as fuel oil, charcoal, hardening compound and chemicals, chargeable to this department. In the machine departments there will be an expense for machine oil and waste. In addition to such supplies there may be special processes requiring supplies, the cost of which should clearly be included in the burden of these processes.

The cost of water is an important item under the heading of supplies. Unfortunately, a charge for water has come to be referred to as a tax, since it usually comes from a municipality. As a matter of fact, it is the purchase price of a commodity exactly like electric current or gas.

Much of the water used in an industrial plant will go to the boilers. Some industries use water liberally in their industrial processes, and the total cost of the supply should be distributed as accurately as possible in accordance with its use.

CHAPTER X

POWER AND STEAM

Power and steam may be purchased, in which case it is a simple matter to determine the costs, and to distribute them according to the relative use of power and of steam in the various departments. If, however, the plant is supplied by its own power station, it is necessary to make a more careful analysis of costs. The power plant should be considered as a separate auxiliary department. The cost of power in its several forms should be determined and subsequently charged to departments and production centers in a manner parallel to that which would be employed by a central station serving a large number of small plants.

Cost of Steam

The first step in the determination of power costs is to determine the cost of steam used in a normal year. The elements of this cost are the fixed charges on the land, buildings and equipment used for the boiler plant, and the operating charges for repairs, labor, fuel, water and sup-

plies. The sum of these elements of cost properly determined is the annual cost of operating the boiler plant, and should be divided by the net output of steam, in terms of thousand pounds, to give a unit cost.

The next step is to make a steam distribution. There are three common uses for steam, primarily to generate power, usually to heat the plant, and also to provide live steam for processes which require it. The steam used in producing power becomes a direct charge to the cost of operating the engine room, or to such other units as pumps or compressors. The steam used in processes is a direct charge to the production centers which use steam, while that used for heating is charged to buildings and included in the rental charge to production centers on a square foot basis along with other building factor charges.¹

Steam for Heating

In those instances where live steam is used for heating, a calculation as to the amount of steam used for this purpose can be made by a comparison of fuel consumption during the winter and summer months, corrections being made if necessary,

¹ See note, page 137.

for variations in the amount of power used during these periods.

It is frequently the case that exhaust steam from the engine is used to heat all, or a portion of the plant. In this event, the amount of steam so used is estimated by determining the quantity required to heat space of this character under normal or average conditions, and the supply of exhaust steam used. Credit should be given to the engine room for the heat so utilized.

In most plants part of the heating is by exhaust steam and part by live steam direct from the boilers. A careful consideration of the facts as suggested above will serve as a basis for calculating charges for both live and exhaust steam.

Cost of Power

Having completed the steam distribution, which includes a charge for steam to the engine room, the cost of power per horse-power hour should next be determined. This is done in a manner parallel to that by which the cost of steam was determined. The engine room will have its fixed charges for land, buildings and equipment, and operating charges for repairs, labor, steam and supplies. This total annual expense should be divided by the amount of power developed, to give

the cost of power per horse-power hour. In order to determine the amount of power developed in a given plant, if switchboard readings are not available (as they are when electricity is generated and used as motive power) the engines should be tested to determine their steam consumption per horse-power hour, which will give the data necessary for calculating the total power developed.

All of this power may be transmitted to production centers in the form of motive power, but it is frequently necessary to make a further division of power charges between motive power distributed directly through shafting and belts, power transformed through generators to electric current used for light and electric heating, and power used by compressors and delivered to production centers in the form of compressed air.

Cost of Light

The amount of power used for light can be estimated from switchboard readings of the output of the lighting generator. The cost of current per kilowatt hour being known, a distribution of the lighting cost is made to buildings from a consideration of the number of kilowatts of lighting capacity installed in each, and the extent of their use. In case lighting is uniform throughout a

building, the cost is distributed to all production centers in the building on a square foot basis, along with other building factor charges. In some instances, however, due to a department operating nights, or being located so that daylight is not available, it may consume more than a pro rata share of lighting costs; or like a storehouse, especially for coarse and bulky goods, may have the least possible lighting installation and a corresponding minimum of cost. In such cases it is necessary to carry the analysis of lighting cost farther than to determine the charge for an entire building. In any event, the method to be followed remains the same.

Compressed Air

The cost of compressed air is determined by adding to the cost of the power required, the fixed and operating charges in connection with the air compressor and auxiliary equipment. The cost of the power required may be a charge per thousand pounds based on the calculated steam consumption of the compressor, or in the case of a belted compressor, the power charge may be based on the calculated power consumption at the predetermined cost per horse-power hour for the plant. This cost should be distributed to production cen-

ters in proportion to their use of compressed air.

To distribute this cost as accurately as conditions permit without going to an unreasonable amount of trouble and expense, a relative unit consumption basis estimated for production centers and departments will probably give the most satisfactory results. To make a distribution of cost, according to this plan, the tools in each department which are operated by compressed air should be listed and classified according to their relative consumption of compressed air. For example, one group might be molding machines of a similar size, another air hoists, another riveting hammers, etc. The air consumption for some one of the smaller classes of tools should be taken as a unit and the relative consumption of the other classes of tools should be expressed as multiples of the unit. In this manner, the requirement of each production center using compressed air will be expressed as a given number of units. Summarizing the unit charges to production centers in each department will give the total units charged to each.

The relative compressed air consumption of the different departments may be expressed on a percentage basis and the expense of operating the air compressor during each cost period, distrib-

uted to departments at the close of the period on the basis of these percentages. If the cost practice requires that operating charges be further distributed to production centers, this distribution can be made in proportion to the units charged each class of tools. In calculating the relative unit charges to production centers, due allowance should be made for leakage and waste, and the relative amount of time which each class of tools is ordinarily used.

In case the consumption of compressed air is large and it is important to have a more careful distribution of this cost, the percentage distribution of charges to departments as determined above may well be checked by the installation of air flow meters in the lines leading to the several departments. The readings from such meters will serve as a basis for a distribution of compressed air costs, in accordance with the actual consumption of compressed air by departments. From this point a distribution to production centers can be made on the unit basis described above, with sufficient accuracy for practical purposes.

Power Distribution

As an aid to making a distribution of power costs, there is a wealth of material available, re-

cording the results of tests as to the consumption of power of various kinds of machine tools and auxiliary machinery to be found in metal working plants. The machine tools should be considered by classes, such as lathes, planers, drills, milling machines, etc., and if there is a wide range in the size of the machines, each class should be further subdivided.

From available data, the average horse-power required by machines of each class and size should next be calculated. When the individual power requirements of all of the machines are summarized, it will undoubtedly be found that the estimated amount of power required considerably exceeds the amount of power generated in the engine room. This is due to the fact that there are considerable periods of time during a day when machine tools are not using power, being down for repairs for the purpose of setting up new jobs, or because there is no work ready for the machines.

Because of this fact, the actual power demand on the engine room is considerably less than the aggregate power rating of the individual machines. After estimating the power required by each group of machines when under load, it is necessary, therefore, to estimate the percentage

of the time each group will use power. The maximum power charge which would be made against each group, if it ran under load all of the time, should be reduced accordingly, and the total amount of power thus charged to production centers compared with the amount of power generated in the power plant, based on past experience. This comparison will check the accuracy of the estimates, since the amount of power distributed should approximately agree with the amount of power generated.

After this power distribution has been completed, the charges to departments can be expressed on a percentage basis, and at the close of each cost period, the cost of power for the period can be distributed to departments on this basis. If the cost accounting calls for a further distribution of power charges to production centers, this distribution can be made in proportion to the relative amount of the departmental total which it was estimated each production center would consume.

In case it is desired to get a more accurate distribution, recording watt meters should be installed in each department, and readings taken at the end of each cost period will afford a basis for distributing power charges of that period to

departments. For practical purposes any further distribution to production centers can be made, in any but the largest plants, on the basis of the original calculations as to the relative amount of the total departmental demand made by individual production centers.

It is sometimes the case that production centers will be found having a seasonal production. Others may operate at infrequent intervals, but when operating makes heavy demands for power. Because of these circumstances it may have been necessary to provide a power plant of sufficient size to supply the demand of these centers when required, but on the average, the plant is operating at only part of its capacity. If power costs are distributed on the basis of power consumed, the cost to those centers having a uniform load would be unjustly increased by the size of the plant necessarily installed to meet the demand of those centers having a fluctuating load. In such cases it is advisable to make a separate distribution of the power plant fixed and operating charges. The fixed charges should be distributed to production centers in proportion to the maximum demand which they are expected to make at any one time, whereas the distribution of operating charges should be based on the power consumption. This

method is parallel with the practice of central stations in making a double charge for power, one rate based on the maximum demand which a customer may require and the other being based on the actual power consumed.

CHAPTER XI

GENERAL EXPENSES AND TOTAL BURDEN

General Factory Expenses

The expense of the planning, cost, payroll, and other similar departments properly chargeable to manufacturing, is largely for the wages of clerks and the salaries of officers. In order to determine the total amount of this expense, however, the burden on the offices and their equipment, as well as the cost of stationery, forms and all office supplies, should be added to the payroll expenditure. Another general expense that must be reckoned with in some form is that incurred for injured employees. In some states this will be a premium as insurance against employers' liability. In other states there will be compulsory contribution to a fund for workmen's compensation. This general expense, including the cost and planning departments, is sometimes known as general manufacturing burden. It may be distributed by two different methods.

General Burden

The first method is to charge this general bur-

den to cost as an additional general overhead, after the direct labor, material and machine rate charges have been accumulated for an order. When this plan is followed, the expense is usually expressed as a rate per direct labor-hour, and an order number will receive a general burden charge in proportion to the number of direct labor-hours which have been charged to it. By a variation of this same method, general manufacturing burden is added to each order as a percentage of the combined cost of labor, material, and direct machine rate charges. Both of these plans have the disadvantage of involving an extra cost calculation, which cannot be made until the previous basic postings have been completed; and because they distribute a heavy expense on a somewhat arbitrary basis, they might not give the results which a more careful analysis of the expense would indicate as proper.

Distribution Following Analysis

It is frequently the case that an analysis can be made of the expense of planning, cost, and other administrative departments, which will indicate a more careful distribution of this expense than would be obtained by using an equal rate per man-hour, or percentage of the manufacturing cost, as

a means of charging general burden to the product made in all departments.

For example, when a large plant is installing a system of scientific management, such a development would probably be by departments, one at a time, rather than for the plant as a whole. It might also be the case that the management would find it unnecessary to develop the principles of scientific management with an equal cost for staff salaries or other expenses in all departments in order to secure satisfactory results. In this event, certainly the expense of a planning office should be charged to departments in proportion to the benefit which they receive from it, rather than to make all departments stand an equal proportional share of the expense, as would be the case if a flat general burden charge, as described on page 165, were made to the cost of work done in all departments.

Similarly the manufacturing conditions may be such as to require a different accounting practice or varying cost methods in connection with different departments and processes. These variations in methods affect the amount of time and expense necessary in the cost department to accumulate the desired information and properly dispose of the departmental records.

Workmen's Compensation

The expense incurred for employers' liability or workmen's compensation varies directly in proportion to the number of employees and the relative danger connected with the operations which they perform. This expense can be distributed to departments and production centers exactly in proportion to the payroll (taking into consideration the different rates charged for the classes of operations performed).

When the charge is conspicuously small in proportion to the total burden it may not be worth while to distribute it separately, but rather to let it go into general burden which is distributed as described on page 165.

Spoiled Work

A special item of burden that has received too little attention is the expense of spoiled or damaged work and defective material. When a job goes bad in a manufacturing department, it is either because the material on which the work is being done is defective, or because the workman has spoiled the job. Spoiling a job may be due either to inaccurate or incomplete instructions, or to the workmen's carelessness or some mishap.

The accumulated cost of spoiled or damaged

work should be reckoned very carefully. If it is due to defective material it may be chargeable to the vendor; certainly that should hold to the extent of the purchase price, and sometimes arrangements are made in the nature of a guaranty, that will cover factory labor and burden on the defective material, or some penalty for defects. Under these circumstances there will be no charge to burden.

If the damage is a more or less inevitable risk attending a certain type of manufacture, so that it will be the expected thing to break or damage a few pieces in every thousand, the result is merely that fewer pieces are finished than were started, and the total cost, less salvage for scrap, if any, is to be divided over the good pieces finished. Here again there is no charge to burden.

But if the spoilage is not of a kind that can properly be assessed against the vendor or the job, it becomes a burden charge for the department in which it occurs.

Salaries of Officers

It is almost always the case that the duties of the salaried officials of a company are capable of analysis and distribution. The heads of the purchasing, planning, cost, engineering and experi-

mental departments illustrate this fact. A consideration of the duties of these officials will indicate to which auxiliary departments their salaries should be charged, and this expense should be further distributed to manufacturing departments and production centers, with the other direct expenses of these auxiliary departments.

Distribution to Centers

Having analyzed this general burden to the extent of determining a fair charge for each of the main manufacturing departments, the distribution from this point to the production centers in each department can probably best be made on a productive labor hour basis. This method is arbitrary, but, having carefully determined the proper expense for the department in total, the distribution is reasonable, and comes as near as any that is available to representing the facts.

To examine all classes of general expense item by item not only secures a better analysis of these general charges, but also includes them in the machine rates as a general burden charge, with the other charges which are capable of exact analysis and distribution by the production centers. This is an important advantage, in that it does away with the necessity for an extra cost calculation

in order to make a general burden charge against each order.

Total Burden and Machine Rates

The factors of expense, whose determination and distribution have been discussed in the preceding chapters of this book, are those most commonly met with in metal working plants. After these expenses have been calculated in total, and distributed to production centers, they should be summarized to give an annual burden for each production center. This burden divided by the standard number of operating hours in the year gives an hourly rate to be used in charging burden to cost.

Standard Running Time

To determine the standard running time per year, the regular number of hours per week should be multiplied by 52 weeks in the year. From this total should be deducted the number of hours lost due to legal holidays and other occasions on which the plant is closed as an annual occurrence. This subtraction gives a standard number of working hours which represents the maximum number of hours which a production center can operate in the course of a year during regular working hours.

Anyone who has given serious thought to the matter realizes that no establishment will operate all its machines continuously every working day in the year. There is frequently a marked difference between theoretically and practicably attainable capacity. Where to draw the line is partly a question of judgment at the start of a machine-hour burden plan.

It comes in time, however, to be a matter of record or experience. In some establishments where careful attention has been given to management, it has long been the rule to keep a daily record of machines operating and machines idle. The cause for idleness is customarily noted as "no work," "operator absent," "under repair" or some other cause (such as failure of gas, hydraulic or compressed air service) that may affect the operation of the machine in question. From such a record the attainable capacity becomes more and more accurately defined by experience.

In this connection it should be noted that the causes for idleness are by no means all alike. "No work" means unused capacity, and should not be deducted from the theoretical to determine the practical capacity. The other factors will apply to different kinds of equipment in widely different degrees.

In a drop forge shop, for example, it would be necessary during the course of a year, to make many minor repairs to the drops during working hours, and it would be practically an impossibility to attain the maximum number of working hours as above determined. In such cases, a reasonable allowance should be calculated, based on a study of production records, and a corresponding reduction made in the maximum attainable number of hours. This total should then be used as a divisor in determining proper hourly rates.

In case there are some operations or processes in a plant, requiring special equipment, which will be used only at infrequent periods, an arbitrary number of working hours should preferably be adopted as a standard, rather than the regular standard time. This practice should be followed with great caution, however, and should not be used to determine rates for the tools which are expected to be regularly employed in production.

After a standard operating time for each class of production centers has been determined, which time is attainable providing there is an available supply of work and production has been properly planned, the failure on the part of a production center to work this number of hours represents wasted time. The cost of this wasted capacity

for manufacturing is reflected in the accumulating burden charges which are not distributed to cost as machine rates, and which are termed "Un-earned Burden." The next chapter will be devoted to a more complete discussion of this loss due to idle machine time.

Burden and Profits

Burden is predominantly the cost of using plant and equipment. To handle burden correctly, not only gives results which in themselves are valuable, but also serves to fix the attention of the management on the elements of cost and the basis of profits, so that a fair comparison may be made between one class of goods and another, particularly to determine which is the most profitable and settle manufacturing and selling policies accordingly.

It is common in most industries to find manufacturers talking of profits per pound, profits per yard, profits per piece. Instead of a profit per unit, attention should be fixed upon a profit per hour for the equipment used. A simple illustration of this is a paper mill, where a large proportion of the expenses are directly connected with the paper machine. On one class of product the machine can turn out, say 30,000 lbs. a day, in com-

parison with as little, probably, as 15,000 lbs. of another kind of product. The profit per lb. on the second kind may be three cents, but only two cents on the first kind. To compare these two merely by the profit per pound would make it appear more advantageous to produce the second product. Making the time analysis as indicated above, it appears that with the product on which the profit is three cents per pound there is a total profit per day of only \$450, but really the first product with a profit of only two cents a pound would give a total profit of \$600 per day.

A net profit per year in a business can naturally be reduced to a profit per month, per week, per day, and per hour if desired, and looked at in this way it is easy to see that it is the order making the greatest profit per hour for the equipment used that makes the greatest net profit at the end of the year.

It is facts like these that make modern cost accounting not only intensely interesting to those who study and practice it, but intensely valuable to the manufacturer who uses it.

CHAPTER XII

UNEARNED BURDEN

The six chapters preceding have discussed the elements of expense which make up burden and have explained how each should be determined in total, and analyzed and grouped by production centers so that a proper burden for each may be known. In the last chapter there is also explained the method of determining a standard number of operating hours for each production center, which is used as a divisor to determine the proper machine-hour rate in each case.

What Unearned Burden Is

From a consideration of the machine-hour rate method of charging burden to cost, it is evident that so long as each production center operates the standard number of hours each year, all of the burden will be charged to cost with the exception of slight variances which may occur between the anticipated burden charges, based on the experience of previous years, and the actual burden charges for the current year. But with a curtail-

ment of production, resulting in idle equipment not used in production, there will be an accumulation of burden charges which is not charged to the cost of the product. This expense is known as "un-earned burden" and is not properly a part of manufacturing cost, although it must be recognized in the determination of a proper selling price.¹

One of the great advantages of the machine-hour rate method of charging burden to cost is the distinction made between burden properly chargeable to cost and unearned burden, which represents the cost of wasted capacity for manufacturing.² A manufacturing cost with unearned burden eliminated serves as a true barometer to *indicate the general efficiency inside the shop.* Unearned burden, known as a separate total, serves as a true barometer to **indicate the effect of the industrial situation outside the shop on the business in question.** A knowledge of both of these factors is essential. They must be known in order to make intelligent selling prices, but *they should be known as separate factors*, so that the informa-

¹ See page 185.

² It is possible, but not usual, to get a normal burden rate on a man-hour or percentage-on-labor basis. When a normal rate is calculated and used, it gives some of the advantages of the machine-hour rate as described in this chapter.

tion given by each can be used to its full advantage. To combine them gives a meaningless total, made up of two independent variables: One, the variation in cost due to manufacturing efficiency; the other, the apparent variation in cost due to the lack of business, because of the prevailing industrial situation.

The False Theory

One great weakness of all of the older methods of charging burden to cost, and a weakness which is also true of the machine-hour rate method, provided the theory of unearned burden is not clearly understood and properly applied, is that they contemplate charging all of the burden against the product made, regardless of whether the plant is running at full or part capacity. The obvious result is that during periods of forced production, costs seem low, while during periods of curtailed production, costs seem high, since all of the burden is distributed over a greater or lesser production.

At the extreme periods in the cycle between business depression and prosperity, the executive is forced to decide the problems of management without the aid of his cost records. In other words, this method of handling burden gives

widely fluctuating costs, and causes many of the present systems of cost accounting to fail just when they are most needed.

The careful and discriminating use of *average* burden costs, as a percentage on labor or otherwise, meets part of this difficulty, but in a clumsy and imperfect way. The use of such averages serves chiefly to combine all the variables, and fails entirely to reflect the variations as they occur, or to reveal their causes.

The Correct Theory of Unearned Burden

Contrary to the general practice stated above, the fact is that **only a part of the total burden is chargeable to the manufacturing cost of the product made during periods of curtailed production, the part chargeable being the same percentage of the total burden as the curtailed production is of the standard production.** The burden not chargeable represents the cost of unused capacity for manufacturing, and is a direct charge against profits.

The cost of this unused capacity for manufacturing must admittedly be met and disposed of in some manner. The method here proposed of separating this expense from the burden properly chargeable to cost not only has the advantage of

being logically correct, but also shows at once why cost figures based on the mistaken theory in such common use must be abandoned in times of business depression.

To illustrate, suppose that a manufacturer establishes two plants in different cities and starts to manufacture ammunition. For a time production is forced and the business is very profitable, but eventually production is so curtailed that one plant is shut down completely while the other operates at normal capacity. The product from the plant still in operation would obviously have the same cost that it had previously, but the continuing burden on the other plant (taxes, insurance, depreciation, interest on the investment, heat, if continued, watchmen, fire protection, etc.) would have to be deducted from the profits made in the working plant. This burden might be so great as to take all the profits out of the business as a whole, but the *cost of producing ammunition* in the first plant would not be increased because the second plant was idle.

If, instead of establishing these factories in different cities, the manufacturer had established them in two different buildings in the same town, he would still have an idle plant eating up the profits of the operating plant.

Again let us suppose that instead of establishing these plants in different buildings, he had placed them in adjoining departments in the same building. Following the illustration to the only logical conclusion, when one of these departments is closed down, it is not fair to add the burden of that department to the cost of the product made in the other, but rather we must consider the burden of that department a drain upon the profits earned by the other department.

The fallacy of charging the burden of idle departments to the cost of the work being done in operating departments is further illustrated if we consider a manufacturer who can either make his product entirely at his own plant or buy some of the parts. At a time when business is poor, his cost records show that a certain part costs \$2 to manufacture, whereas it could be purchased for \$1.80. The elements of the \$2 cost are 40 cents for material, 80 cents for labor and 80 cents for burden. During a busy period the cost of the piece was \$1.60 because the burden charge was then 40 cents instead of 80 cents.

Now if the manufacturer had found that he could buy the parts at a saving of 20 cents each *when operating at full capacity*, he might well have done so. His costs would then have shown him an op-

portunity to save money. But if he is guided blindly by his costs in a dull period and purchases the parts he simply increases his losses. Any executive would realize that, although it apparently cost 20 cents more to make the part than to buy it, the 80 cents burden carried by the part when made would have to be recovered out of the profits on the other work if the part was bought outside.

The manufacturer knows, therefore, that he will lose the least money by continuing to make the parts at an apparent loss.¹ In doing so he disregards his costs. They have failed. Unconsciously perhaps, he admits that he has a fair weather cost system, and that there is something fundamentally wrong which makes his costs useless as a guide except under normal conditions—when they are least needed.

In this simple illustration it is easy to see why the manufacturer should continue to make the part rather than buy outside. But unfortunately when a manufacturer is conducting a large and varied business, the problem of knowing on which part and product he is making or losing money, and of forming manufacturing and selling policies based on this knowledge, is a much more difficult

¹ For a more detailed discussion of a related point, see page 288.

matter. Consequently, those executives who believe that all burden should be added to the cost of the product made, however curtailed the production may be, must disregard their cost figures entirely at such times and guide their business by "judgment." We all realize that by following the false theory they would simply force themselves out of business.

A cost system which will be dependable under all business conditions must, therefore, take into consideration the fact that every manufacturing plant has the capacity for a certain production, and incurs burden charges in maintaining that capacity, and that these charges must be distributed over the standard production. This means the determination of machine rates, or standard hourly charges, for the use of each production center, and an accumulation of expense representing the cost of wasted capacity when the production center is idle.

Lost working time may be due to mismanagement or to general trade depression. A portion of the burden under these conditions will remain unabsorbed in cost, since part of the equipment has been idle. But the *cost of the product made* in other production centers during this time has not been any greater because of the idle produc-

tion centers. Thus the influence of varying production on costs is removed, and costs rise or fall directly with the manufacturing efficiency of the factory, unaffected by the influences of varying volumes of output.

The unearned burden in any one department usually represents conditions beyond the control of the department itself, but with unearned burden eliminated, the unit cost of similar orders may be fairly compared from one period to another, and made the basis for a satisfactory measure of the operating efficiency of the department.

Standards for Costs

These unit costs may always be compared with the standards of efficiency which have been established. If the cost accounting is to be of maximum value, much emphasis must be laid on the importance of knowing more than present cost alone. Costs should be established which represent standards by which to gain a true conception of the value of results. It is impossible to ascertain whether or not a standard is being realized, if indeed it is not impossible to establish the standard itself, when the accidental circumstances of existing business conditions are allowed to influence the cost figures.

When the efficiency of a department is measured in this manner, there is no guesswork by which a foreman is able to dodge responsibility that is really his. Analysis of the burden charges shows that certain expenses are under his direct control. If he is made responsible for these expenses and perhaps given inducements for cutting them down, a substantial saving can often be made.

Method of Handling Unearned Burden

Because unearned burden is not properly chargeable to manufacturing cost does not mean, however, that this expense can be noted and promptly forgotten. If this were done, and **selling prices were based on manufacturing costs only**, a manufacturer might find that there was sufficient unearned burden to wipe out his apparent margin of profit and put him out of business. The amount of unearned burden incident to the operation of a business must be taken into consideration when making selling prices. This should not be the unearned burden at any particular time, nor perhaps for any one year, but a figure based on an intelligent survey of past industrial conditions, and an attempt to forecast what the future may bring forth.

For the purpose of estimating selling prices

this expense can probably best be expressed as a percentage of manufacturing costs. It will also be advisable to determine this percentage by classes of product, if some lines contribute more heavily than others toward making up the total unearned burden. In a paper mill, for example, manufacturing both machine dried and loft dried paper, long runs on machine dried paper would leave the loft drying facilities entirely unutilized. In a textile mill making a variety of products, there would be a classification of equipment on different lines of manufacture, and through a series of years there would undoubtedly be more idleness in some departments than others. There would be a similar problem in a factory making both wood and steel furniture.

These illustrations will serve to indicate the scope and character of the problem. It is possible always to allocate the unearned burden at the points where it occurs. Whenever it is possible also to analyze the unearned burden as a factor of the selling price of the different kinds of product, that should be done.

Monthly cost reports show comparatively the amount of unearned burden, indicating the tendency of business conditions. This unearned burden may either be charged off each period to Loss

and Gain, or a reserve may be accumulated out of profits during busy times, to which the unearned burden may be charged during times of business depression. Because of the alternate periods of depression and prosperity, it is vitally important to know the cost of unused capacity in times of depression and to provide for it in times of prosperity. The distribution of earnings to stockholders is stabilized by accumulating in this way a surplus from part of the earnings of good years in order that dividends may continue to be paid during subsequent poor years when earnings fall off.

When burden has been handled as outlined, the executive knows each month what percentage of the total burden is unearned, and the amount of this unearned burden in dollars and cents. He should know what this will average in one, three or five years. He should know how much his selling prices must be increased in order to meet the average cost of unearned burden. Or, assuming that selling prices are so fixed by competition, or other conditions, that it is absolutely impossible to increase them, he should also know how much the volume of his sales must be increased, to accomplish the desired end.

The cost of unearned burden must be met, either

by increasing prices, so that the increased revenue will provide a profit to offset the expense of unearned burden, or by increasing sales, and therefore, volume of product, to the point where there will be no unearned burden. If these alternatives are impossible, then unearned burden will be a direct drain on Profit and Loss, and if this drain continually exceeds the net profits from manufacturing, the business will be a failure.

By having these pertinent figures continually before him, an executive can see absolutely in which direction his business is heading. He will have records which can be relied upon under all business conditions to give such information as will enable him to plan his manufacturing and selling policies to the best advantage.

CHAPTER XIII

THE VERIFICATION OF BURDEN ESTIMATES

The analysis of the elements of cost making up burden, the careful determination of hourly rates, and the separation of unearned burden from manufacturing costs insures burden charges which are correct. In order to make this method a complete success, however, provision should be made for proving by the proper accumulation of cost records that the scheduled burden, determined as described in Chapters VIII-XI continues to be proper, and that increases in plant, changing manufacturing conditions, or economies introduced, have not brought about results which necessitate the revision of the hourly rates.

This proof is secured by setting up the calculated burden of each department as a standard with which to compare current costs. A comparison of the scheduled and actual burden charges by departments is usually a sufficient analysis for practical purposes, although in the case of very large production centers, the comparison may preferably be made by these centers. Since

the burden charges are developed in detail by production centers, the burden factor charges to all centers in a department should be summarized to give the total of each of the factors for the department (as well as the total department burden).

Four Week Periods

The practice of making cost comparisons on the basis of thirteen four week periods during the calendar year is gradually increasing. This plan can be readily incorporated with the general accounting, and it is obviously advantageous from a cost accounting point of view, to have comparative cost periods more nearly equal in length.¹ The scheduled burden of each department for the year should, therefore, be divided into thirteen equal parts. This applies not only to the total, but to each of the factors making up the total burden, so that the accumulation of current burden costs can be compared item for item with the schedule.

It will be found that the actual costs of some factors can preferably be debited each week, while

¹ There are a few establishments, especially those which do not pay in even weekly or two weekly periods, in which this plan should not be recommended.

others will receive a debit but once a period. In order to keep the current cost work up to date, it is advisable to make as many weekly entries as possible, rather than to allow a considerable amount of work to accumulate until the close of a period, which delays closing the general books and diminishes the value of the cost records accordingly. These weekly debits can usually include the cost of supplies requisitioned by each department during the week, the indirect labor charges to departments from the weekly payroll analysis, and the cost of departmental repairs, summarized from the material, labor and burden charges for the work done during the week by the maintenance department.

At the end of each four week or monthly period those factors which can best be distributed periodically are totaled and distributed to departments. The cost of operating the power plant, for example, will be accumulated for the period and at the end of this time, this actual expense will be distributed to departments either on the basis of actual power delivered, if meter readings are available; or on the basis of percentages, if this course is necessary. A standard journal entry will also be made each period, which will debit each department with its scheduled share of in-

terest on investment, taxes, insurance and depreciation, known in total as fixed charges, and credit corresponding reserve accounts.

Burden Variance

Summarizing the actual expense of all of the factors making up burden, gives the total expense of each factor and also the total departmental burden for the period. This summary affords a direct comparison between the scheduled cost of each of the burden factors and the actual cost. A difference between the estimated and the actual expense is known as a burden variance. A continued burden variance, either over or under the schedule, indicates an error in setting the schedule, or a change in the amount of the expense, and a revision of the schedule and hourly rates should be made accordingly.

It will be noted that some of the factors which make up the total burden are under the control of the executives, while the expense of other factors is directly under the supervision of the heads of departments. For example, rent and equipment charges which have been termed fixed charges, bear a direct relation to the investment which the executives have made in buildings and equipment. An increase in the amount of these

fixed charges is the result of a decision on the part of the management to increase the amount of capital invested.

Fixing Responsibility

The second class of charges are under the direct supervision of the department heads. These charges are for supplies, repairs, indirect labor, etc. The proposed method of summarizing current burden costs, and comparing them with standard scheduled costs, affords a continuous check to indicate the economy with which these expenses are being incurred. A review of these current burden charges will show immediately when any foreman is allowing his payroll for indirect labor to increase out of proportion to the work which he is turning out. Similarly the cost of supplies used in each department can be compared period after period and any increase in this cost at once known. The cost of the repairs which a foreman is ordering is summarized and compared with the scheduled charge. These are practical examples of an expense budget.¹

When the burden in each department has been carefully scheduled by elements, or component parts, and proven to be accurate by the accumula-

¹ See Chapter XIV.

tion of current costs, there is no guesswork by which a foreman can dodge responsibility that is really his, when costs are found to be increasing. The majority of the operating burden charges are under his direct supervision, and if he is made responsible for these expenses and perhaps given inducement for cutting them down, a substantial saving can often be made. Certainly any increase in cost can be investigated, promptly and checked, unless the increase is found to be warranted by a corresponding volume of production. Actual costs compared with standard scheduled costs accurately measure the value of the results obtained.

Supplies in Burden

In the case of materials or supplies, such as paint, lacquer, insulating, or plating materials, which may be handled as a burden charge or a scheduled cost, the supplies factor may be further analyzed to give a periodical comparison of the cost of the individual supplies consumed. This comparison not only serves the purpose of proving that the charges to cost have been correct, but when the cost of the supplies consumed is compared with corresponding cost and production records, the economy of their use is at once indicated.

Burden Earned

The amount of each department's burden which has been charged to cost by the hourly rates during the four week period should be summarized and compared with the actual burden for the period. The difference between the burden charged to cost and the actual burden for the period represents unearned burden, which, when summarized for all of the departments in the plant, represents the total unearned burden for the period. The earned burden, or the burden which has been charged to cost during the period, is entered as a credit against the total burden of the department. The corresponding debits have been made when burden charges were posted to cost cards, or in total to Work-in-Process.

The unearned burden, or the balance still remaining in the departmental accounts, should be closed to Loss and Gain¹ for the period, since these charges represent the cost due to idle capacity for manufacturing. The information which can be obtained from this monthly recapitulation and comparison of scheduled burden, actual burden, earned burden and unearned burden, becomes an almost indispensable source of information.

¹ See pages 184-187.

In the preceding chapters of this book we have discussed the methods of accumulating material, labor and burden charges to give a manufacturing cost. A brief summary may serve to fix the main arguments in the reader's mind.

It is impossible properly to determine the cost of a product, unless each *element* of cost is properly determined and accumulated. The principal weakness in methods of cost accounting now in general use is that *burden* charges are not accurately analyzed and distributed to cost, and therefore correct charges cannot be made to different lines of product for the relative expense of using the different kinds of equipment required in their manufacture.

Furthermore, since all of the burden is usually charged to the cost of the product made, costs *seem* to vary not only with manufacturing efficiency, but with volume of manufacture at the time. As there is no relation between these two variables, the average is without meaning.

The difficulties which have heretofore generally stood in the way of accurate burden charges, may be met as outlined in the preceding chapters, and by the method of analyzing, scheduling and distributing burden as described in this book the elements making up burden can be charged to cost

on a logical basis, and as definitely and accurately as labor and material costs.

The practice of distinguishing between burden earned and properly charged to manufacturing cost, and unearned burden, which is a charge to the Loss and Gain account, removes entirely the improper influence on cost of varying volumes of production, and consequently allows the cost figure to reflect the true tendency of efficiency within the shop.

Finally the periodical summary of operating expenses by departments compared with the estimated expenditures affords a continual check, not only to insure that the scheduled burden is correct, but also as to the efficiency with which these expenditures are being made.

CHAPTER XIV

THE BUDGET SYSTEM

In discussing public finance, one hears a great deal about budgets, and budget systems are coming into use in many progressive manufacturing establishments. The idea is given effect in part by just such an analysis of expense as that which has been described in the preceding chapters of this book, separating the fixed charges from the variable costs, and scheduling both, but particularly the variables, with as much accuracy and precision as the available information will permit.

When the variable items of factory expense are considered in detail, attention is immediately fixed on the kinds of expense that are incurred, and the means that may be employed for keeping them under control. Supplies, for example, get into cost by being issued from a storeroom. Indirect labor mounts up as a departmental charge when the superintendent or foreman employs additional helpers, or truckers. The wasteful use of supplies and the employment of unnecessary indirect

or so-called "non-productive" workers are some of the characteristic leaks in industries which are to be stopped only by a systematic control of such expenses. This means establishing definite lines of responsibility, with some plan to be sure that a control is effective and the responsibility enforced.

Forecasts of Expenses

Some large organizations have found it highly advantageous to have each department head submit an estimate of his expenses for the coming year. This budget is then passed upon by the chief executive, the appropriation made, and the department manager is expected to keep within the appropriation. The budget may be made to cover the expense of operating on the basis of a production equal to that of the period just passed, or a production increased to any extent which the management may wish to contemplate. Provision may also be made for experimental work, the installation of new methods, or for any conditions that may arise.

The writer knows of organizations where this plan has worked very successfully both from the viewpoint of the management and the department chiefs. It gives the management accurate infor-

mation on which to base financial arrangements, and once the appropriation is fixed, there is no necessity for further attention to details of expenses, except as reports may indicate that a certain department is running over its appropriation. It puts the responsibility on the department head for watching the detailed expenses, and by giving him a more direct insight into the financial side of his department, creates an interest not easily secured in any other way. In a broad way the management is only interested to see that the department heads keep within their appropriation as a whole, not seriously concerning itself if one item of expense exceeds the appropriation, providing this is offset by a decrease in some other expense.

Illogical Curtailment

Too often it is the case that the manager of an organization, lacking accurate information as to departmental expenses, and feeling only that expenses must be reduced somewhere, calls first one department head and then another, and demands an arbitrary decrease in the expense of their several departments. The department heads in their turn, having no accurate information, but feeling only the spur of the management, and the neces-

sity of cutting expenses somewhere, curtail labor force or dispense with certain information without any sufficient consideration of the results. This is probably unfair to some of the discharged employees. The information dispensed with may be highly important, and the general result is that the curtailment is applied unintelligently, producing a general feeling of discontent and injustice, and frequently decreasing rather than increasing the net profits.

Departmental Budgets

There are great possibilities in a budget plan in a well organized business. The head of a comparatively large department may demand budgets from the heads of the several divisions under him, and some organizations go so far as to get budgets from foremen covering supplies and other expenses. In the case of supplies, a foreman is asked not only to give a budget for his requirements for a year, but also to give the storekeeper his monthly requirements a few days before the beginning of the month. These supplies are then set aside for him and delivered as he may require, but he cannot exceed his budget without approval from the superintendent. This plan, which has been worked out successfully in large indus-

trial plants and on some well managed railroads, is simply the budget plan carried a few steps farther.

Many of the items of expense which are incurred by the department heads are influenced by the volume of business done, or by other factors which are beyond their individual control. It is surprising, however, how these items increase beyond their just proportions when not closely watched by some one in touch with conditions.

Plan Demands Accurate Accounting

Another advantage of a budget system, and by no means the least important one, is that it compels an accurate distribution of all charges by the accounting department. Under this plan a department head making his estimate for the coming year's expenses from records of past performances, is going to be doubly sure that these records are accurate, and also that after a budget is once agreed upon and the appropriation settled, he is charged only with items which properly belong to his department, and no more than a fair share of the expenses which are distributed over several departments.

In respect to budgets for current operating expenses, it is particularly essential that the accounting methods be scientific. It goes without saying

that the accounts must be correct, but that is not enough. A business should be scientifically studied with the object of learning all the facts and then a system of accounting installed whereby these facts will be intelligently assembled and recorded, and presented to the executives in a readable form.

Preparing for Increased Production

In a business conducted largely on borrowed capital, or where the volume of the factory output must be determined some months ahead, it is necessary for the executives to know what the expenses for the coming year are to be. Often this is approximated by taking a percentage of the direct labor, or selling price, as shown by the previous year's operations; but all too frequently the results at the end of the year do not agree with this estimate. In a business of any size, there are too many items which have no direct relation to each other and are influenced in varying degrees by diverse factors, to permit the determination of a safe total in such a manner. With the proper records, however, an executive or department head can very accurately forecast any item of expense.

Perhaps one of the most difficult problems which

an executive has to solve is that of preparing for production on a much larger scale, either through the building of additional factories, or a purchase of additional equipment to install in the old factory. In either case he probably knows what his direct labor costs and material costs will be, but as a rule he has no accurate information on which to base an estimate of the other expenses he will have to incur to take care of this increased production.

If the problem is approached with the right kind of analytical methods, it is surprising to find how nearly every item of expense can be determined in advance and standards or schedules determined by which subsequent operations may be checked.

The budget idea may be as easily applied to asset expenditures as to operating expenses, and the request for an appropriation for new or improved equipment may be accompanied by an estimate of the saving anticipated. This estimate should later be checked with the actual performance.

Both assets and operating expenses must be considered in the financial program of any business that is growing rapidly, and executives who have accustomed themselves to forecasts arranged

in this way, operate with a degree of security which no other methods can provide.

Budgets for a Small Business

The impression may be gained from a reading of this chapter that the budget idea is applicable only to a huge business in which the executive is removed from detail and gives numerous subordinates large responsibilities for expenditures. Under such circumstances, it is true, the budget plan is well nigh indispensable for intelligent or successful management, but in many a smaller business there is much to be gained if the manager, even if he be the sole proprietor, will forecast his operations, being guided as much as possible by previous experience and, of course, taking into account such changes and developments as are likely to occur.

In any business, large or small, it is certainly a tremendous advantage to analyze the expenses, separating those that may vary from those that are practically fixed, and making such a record of the variables that those in charge can know whether they are reasonable with reference to the volume of product, or other variable factors in operating conditions.

CHAPTER XV

MONTHLY STATEMENTS

Reference has already been made (at the conclusion of Chapter XII) to the importance and the great practical utility of the right kind of cost reports for monthly or four weeks periods. Unfortunately, too many establishments depend too much, or perhaps exclusively, on periodical factory or shop reports; and while they will usually have some very useful cost information, they do not have it properly coördinated, or, as the expression is almost universally used, "tied in" with the general bookkeeping.

In a modern industrial establishment it is highly desirable to go further and provide suitable and regular reports for financial control in the shape of periodical balance sheets and profit and loss statements. A good cost system is indispensable for securing reports of this character in an industrial establishment.

Balance Sheet

According to the kind of bookkeeping that was universal a few years ago, and which unfortunately

still lingers as the only guide to final results in a great many establishments, an inventory would be taken annually, or possibly more or less frequently, and only on the dates of such stock-taking would the owners have anything like an accurate statement of their assets, and accordingly of their profits since the preceding inventory period.

When an adequate cost system is in operation, it is a simple matter to operate controlling accounts which will represent the current balances in inventories of all kinds, including work-in-process, as well as raw materials and finished goods. The value of purchased goods is naturally added to these inventories. The cost system keeps track of the transfers of values from raw material, through work-in-process, to inventories of finished goods, from which withdrawals are subtracted (and charged against cost of goods sold).

As these are the asset items that change in value from month to month, as work progresses between inventories, and a cost system makes it possible to know these values accurately, the management can have a dependable balance sheet on any convenient closing date without the trouble and expense of an actual stock-taking. Cash and accounts receivable among current assets, and plant values, are easy enough to know in total at all

times; and liabilities for notes and accounts payable, accrued obligations, and bonded debts are usually correctly and completely stated.

With known inventory assets, therefore, the executives may have a complete balance sheet to which they can refer with confidence for the financial standing of the business. This is frequently a great convenience to a concern that is maintaining close relations with bankers or note brokers, and would like to present dependable statements at short notice or frequent intervals. The fact that a concern can do this has a favorable influence on the "live" credit men among the bankers.

Profit and Loss Statement

The kind of financial control afforded by annual or even semi-annual inventories is today generally regarded as insufficient for all but the smallest establishments, in which all of the details of the business come under the immediate personal supervision of one or two partners or executives. It is dangerous, moreover, to rely on annual inventories for information as to how the business is progressing, and accurate information in regard to progress is frequently of greater importance than the balance sheet; for it often happens that everybody concerned knows (without an

actual balance sheet) that the enterprise can meet all its obligations, whereas they do not know, as they should at frequent and regular intervals, whether it is making or losing money, and how much.

This knowledge as to profits from current operations is easily enough secured if only the management has an accurate report of the cost value of goods sold, and of the various expenses of the business, chargeable to manufacturing cost or otherwise, as defined in the preceding chapters of this volume.

In support of the Loss and Gain statement to be prepared every month, or every four weeks, it is to be expected that the accounting department will supply the executives with statements in appropriate form for each department, showing such significant items as direct charges (the so-called "productive" labor and material consumed), burden absorbed or applied, units or quantity of product turned out, and the details of indirect charges of every kind, as defined in Chapters VI to XIII, inclusive. If these figures for each month, or four weeks' period, are checked against the previously established budget, as described in Chapter XIV, the executives will have a very close control of factory operations.

CHAPTER XVI

FOUNDRY COSTS

Too many foundries are being directed without adequate information coming to the executives as to the cost of the product of different kinds, or for different customers; without sufficient control of expense, or adequate information regarding the cost of unused capacity; and all too frequently without a production plan which will enable the management to get the largest output and the greatest profit from the facilities available. This is due to the widespread belief that it is impossible, or impracticable from the standpoint of clerical expense, to have more accurate information.

There are few foundry executives, however, who doubt that they could use precise information of this kind for a more efficient conduct of their operations, if only they could get the records that they need promptly and economically. It is the purpose of this chapter to point out how these results, admitted by all to be so highly desirable, can be secured.

Objects of Foundry Cost Accounting

There are three principal objects to be attained by operating an adequate cost and accounting practice in a foundry.

First, the management should know the costs on each line of work, and therefore the profits on the product made for the individual customer. The importance of this information will vary in different communities, and in different foundries, according to the number of customers served and the amount of competition, and therefore the accuracy with which quotations must be made. (As to customers this applies only to a jobbing foundry.)

Second, it is all-important that the foundry management should have daily reports, and weekly and monthly summaries, of the cost of foundry operations. If the volume of work is fluctuating, it is obviously necessary to watch closely the relation between direct molding and core making labor and miscellaneous indirect operating costs. There will naturally be daily reports showing the kind and quantity of material charged, the ratio of metal to fuel, the amount of metal poured out of the daily melt, and the proportion of good and bad castings made. Some of this is only statistical information, and some of it, as, for example,

the cost of spoiled castings, becomes much more significant when reduced to dollars and cents.

Third, if a foundry is asked to make individual castings which are important as to weight, difficulty of molding, core making, cleaning, requirements as to metal, hardness, etc., so that special attention is required at every stage, it will be desirable in such special cases to calculate the cost of individual castings (that is, individual patterns). In a jobbing foundry, handling work for different customers, the character of their patterns will obviously be taken into account in quoting a price, and if that price is uniform for all the requirements of one customer there is not much to be gained by attempting to get costs on individual castings, except occasionally to see that one or two patterns are not costing too much above the average.

But in a foundry where the work is done almost solely for the machine shop in the same business, the only kind of cost accounting beyond averages that will be of much value is one that will get costs on individual castings, or possibly on groups, like the castings for a line of pumps, for example, in contrast with a line of gasoline engines, if both are made in the same foundry and machine shop.

From this brief survey it is plain that the object

to be secured by cost accounting will vary greatly in different foundries, so that what may be an obvious necessity in one plant will be a matter of indifference in another. The reader should bear this carefully in mind in reading the following paragraphs.

Production

An adequate production scheme is one of the essentials for efficient foundry management. It is also the framework for the cost accounting.

There should be a record of all patterns on hand, properly indexed so that they may readily be located. This record should show the date, and from whom received, storage location, pattern number, and how many castings are to be made from each pattern. When customers' patterns are returned the date of the return should be noted on the pattern record before the card is removed to the transfer file.

Upon receipt of an order for castings at least three copies of the production order can be used effectively. One should remain in the production department, filed by customers or manufacturing classification, and two copies go forward to the foundry foreman, one for his file and one as an order for patterns. A summary of these orders

is kept by the production clerk, classified by customers, and if desirable for production purposes, according to weight of castings or grade of metal. A color scheme may be used in connection with production orders, different colors representing the various weight or grade classifications. A daily analysis of this summary is made by the production clerk and foundry foreman, and the production for succeeding days determined. Postings are made to this record crediting the good castings made each day, and leaving as a balance the number of castings for each pattern yet to be made.

When new patterns are received at the foundry the gross weight of castings to be made from these patterns is calculated. By maintaining the record outlined in the preceding paragraph, the production ahead of the plant can be closely estimated.

Production orders as issued to the foundry should be given serial numbers. These order numbers can be so arranged as to indicate a customer, a class of work, a pattern, or if desirable, all three.

Labor

The labor cost will be sharply divided between direct and indirect charges. Even if the direct

charges are not further subdivided, the total payroll should be separated into cupola labor, molding, core making, cleaning, pattern work, and carpenter shop. In most cases there should be a subdivision of molding and core making labor which will show the time consumed by molders and core makers against individual production orders (and on large work, on which cleaning is important, a similar division of cleaning labor).

All *indirect* labor (except that connected with the molding and core making—and possibly cleaning departments) should be charged to appropriate burden centers and subsequently distributed to job cost cards on the basis of pounds of good castings made. The indirect labor associated with molding and core making will be charged from the labor distribution to the molding or core making burden centers, and applied to costs through the hourly burden rate of these centers.

Materials and Supplies

The principal material costs in a foundry are those for pig iron, scrap and fuel charged into the cupola. There is also a considerable expense for molding and core making supplies, brick, furnace linings, and general items such as heating fuel, building and equipment repairs, etc. The dis-

position of these miscellaneous charges will be discussed in a subsequent paragraph.

The material charged to the cupola is the principal cost of melted metal, although the total cost of metal is composed of fixed charges on the investment in cupola equipment and raw material inventories, cupola repairs and the labor of the cupola gang. In any well run foundry there is a daily report of materials charged, and weekly and monthly summaries, from which the values of the materials consumed may be readily calculated as a charge to the cost of melted metal.

A perpetual inventory should be maintained for all materials and supplies. This does not necessarily mean that detailed stores cards should be maintained, covering all items of supplies. But separate accounts should be kept (including freight as well as purchase price—and unloading costs when kept separate) for such important items as pig iron, scrap, coke, molding sand, etc. General supplies may well be grouped in a store-room, for which one person should be responsible. The balances on hand may be checked individually as convenient. If various sections of the inventory are checked at regular intervals, a very accurate record can be maintained, so that it is possible to prepare a reliable statement of Loss

and Gain at the end of each period without taking a physical inventory.

It is highly advisable that such supplies as nails, gagers, etc., be kept under stores control. Large savings have been effected by requiring the foreman of the molding and core making departments to issue requisitions for this class of supplies, which are a charge to burden in the respective departments.

Burden

Overhead charges or burden is an important part of the cost of product in an ordinary foundry. Foundry land, it is true, is usually cheap, and the buildings are relatively inexpensive; but repairs are high, especially to cupola and equipment, if they are to be kept in good order; depreciation is rapid, and the current charges for supervision, indirect labor, and supplies are considerable. It is highly important that the current charges should be allocated and charged to the product accurately.

The natural divisions of a foundry are the cupola and the departments for molding, core making and cleaning. A large space may be devoted to pattern storage, and in some foundries, to a pattern shop, and a carpenter shop for repairs.

The land and building charges and the fixed charges on equipment, described in detail in Chapters VI to IX will be determined and assessed to departments according to the space they occupy, and the value of the equipment which they use.

The labor cost for foremen will be part of the burden of molding and of core making, and of the pattern shop and carpenter shop if they are large enough to have charges of this kind. Cleaning labor may all be thrown together and assessed, with other general charges as a cost per hundred pounds on all the work done, but if the foundry is handling large castings which individually take several hours to be cleaned or chipped, these costs should be charged separately just as much as molding or core making labor, and in such cases the labor of foremen will be charged to burden as in other departments.

Some foundry executives may question the importance of dividing overhead or burden as above described. They may believe that average costs for metal, molding, core making, cleaning, etc., are all that is necessary, and where the product is very uniform, a fairly good control of foundry operations may be secured in this way.

All foundrymen, however, recognize the widely

varying labor costs for molding and core making on castings of different weights and different shapes. It is the difference in labor cost that attracts attention, but it takes only a little analysis to show that there is a burden on molding separate from that on core making. If an accurate distinction between the cost of light and heavy castings is desired, it is essential to separate the burden costs as well as the labor costs, and charge these burdens in proportion to the work actually done in the respective departments and not as a flat average over the entire output.

Collecting Casting Costs

The elements of cost in a casting are the cost of metal at the spout, and the costs of molding, core making and cleaning. There is overhead or burden to be reckoned in connection with all these costs, and there are certain general expenses, as for power, heat and light and supervision, that must be considered and spread in an appropriate way over the product.

These costs will be accumulated on job cards for individual production orders. It is a question of discretion as to just what a production order should cover. In most foundries it will stand for a class of product, or for an individual customer's

requirements, but in some instances, as previously noted, individual castings will be made on separate production orders.

A job card should provide for the hours and amount of core making and molding labor, pounds of good and defective castings made, and a memorandum as to the loss through returns and allowances. The hours and amount of core making and molding labor will be posted from daily labor tickets, and the weight of castings, both good and defective, from the daily production reports. A memorandum of loss by returns and allowances will be obtained from the accounting department as credits are issued.

The burden of the core making and molding departments will be applied to the corresponding labor charges, preferably on the basis of the productive hours already charged.

If the work is large, cleaning labor and burden will appear as separate items on the individual cards. Any charges for patterns, or machine work that may be done strictly as a foundry cost, will be accumulated on a separate cost card, but should be included on the cost-of-castings card under the heading of Other Charges.

Cost of Metal

The cost of metal at the spout, as accumulated in the account set up for this purpose, is to be distributed to the job cards in proportion to castings made. Some managements will desire to have the material cost of metal and the cupola operating or conversion cost shown separately¹ on the production orders; but if this division is made, it seems logical to go a step further and show cupola material, labor and burden all separately.

Just what course is adopted in this respect will depend on the view taken in regard to defective castings, and as it cannot always be known whether castings are defective as soon as they are broken out of the sand, it seems wiser to distribute all of the cupola costs to all of the castings made. Those that prove defective have a scrap value. If this is regarded as equal to the average cost of the cupola charge, the cost of the defective castings will be merely the molding and core making labor and burden (and conversion cost, if stated separately from other cupola costs) which has been incurred in their making.

The same result can be secured by distributing the cost of metal on the basis of good castings made, and distributing the cupola labor, burden

¹ These costs are separate, of course, on the cupola report.

and fuel on the total weight of castings made, both good and defective.

A total will be obtained as to both gross weight and amount, from which the weight only of defective castings will be deducted, if the metal cost is charged on the basis of good castings. If the metal cost is on the basis of gross weight, both the weight and value of scrap will be deducted. According to either plan, this will leave the *net weight* of good castings, and the *total cost* of both good and defective, less the scrap value of the defective castings.

General Burden

To the cost as above determined, general burden should be applied, representing miscellaneous foundry expenses, at a rate per hundred pounds.

One who has read attentively Chapters VI to XIII, inclusive, will understand clearly how the elements of burden in a foundry are to be recognized and distributed, but after the best possible analysis of charges of this character, and their distribution to cupola, and to the departments of molding, core making, cleaning, etc., some general charges will remain for such items as general supervision, clerical labor, shipping, delivery and

the costs of defective castings returned from customers (less scrap value). If the product is fairly uniform and rather small, all the costs of cleaning can be conveniently thrown in the general burden and distributed on a pound basis.

Pattern Expense

The expense for flasks and patterns, including repairs as well as fixed charges, is logically part of the molding burden, but this is sometimes thrown into general burden.

The policy of different foundries will naturally vary in respect to the cost of new patterns. In a jobbing foundry where the customers own the patterns this factor will not have to be considered, but in a foundry making for its own machine shop, it will be considered part of the foundry cost. The general upkeep of patterns may fairly be included in molding burden, but the cost of new patterns should be accumulated on individual pattern orders, even if the final charge is to an expense account.

Patterns are an asset to a certain extent, and if a foundry is rapidly increasing its line, it is logical to increase the asset in patterns, but after a line has been fully established an increase in the assets on account of patterns should be made very

cautiously, and practically all expense of this kind charged as maintenance.

Summarizing Costs

To complete an adequate cost and accounting plan for a foundry, provision should be made for summarizing various records. The distribution of labor and materials and also the development of burden, has already been explained.

The total cost of the cupola will be distributed to individual production orders or job cards, according to one of the two plans previously outlined, and the total will be a credit to the Cupola account and a charge to individual orders. A summary of the production orders in respect to labor and departmental burden will provide credits to the respective labor and burden accounts, and the total cost of the finished castings will be charged to an account called "Cost of Goods Sold" by individual customers, if immediately shipped, or be transferred to a machine shop inventory. The foundry cost cards should be designed to provide for a convenient posting of shipments (weight and cost value), and to carry forward the remaining inventory to the operations of the next period.¹

¹ A few foundries maintain a stock of clean castings that have not been machined, but this is almost uniformly for the

On continuous jobs, such as work for a regular customer, or on any special work that is not finished in the month in which it is started, there will be material, labor and burden costs in the succeeding period, in addition to those brought forward from the previous period. The balances, both weights and cost values, determined at the end of each period (month or four weeks) are an inventory of work-in-process, and the total of the balances on the job cards should agree with the controlling account in the general ledger. This bookkeeping agreement should be established as a matter of course every period, and a physical inventory should be taken and compared with the job cards from time to time as may be convenient, so that the management may be sure that the values and the weights are actually on hand.

Upon each cost card there should be provision for such information as the selling price, cost of goods sold, gross profit, loss on returns and allowances and net profit. These items should be proved, by means of summaries, with the controlling accounts in the ledger.

benefit of the machine shop rather than the foundry, and the value of such raw castings is much better transferred to the raw material inventory in the machine shop, rather than carried as inventory of finished work in the foundry.

With an accounting plan in operation as defined in this chapter, the management of any foundry can have accurate costs on each class of castings made or sold, know profits on each customer, and have at the end of the month a dependable balance sheet and earnings statement. These results, moreover, can be secured with a surprisingly small amount of clerical labor beyond what is absolutely necessary for the orderly conduct of any business.

Foundry and Machine Shop Separate

So many foundries operate in conjunction with machine shops under the same management, that it seems in order to add a word of caution that the management should always make sure that the cost of operations are equitably divided between machine shop and foundry. This is particularly important to a company that is doing jobbing work in the foundry, besides supplying castings for its own shop. The income from casting sales will naturally be set apart, but unless special care is taken, the charges applicable to the foundry will not be known and determined with equal accuracy.

A foundry that is doing jobbing work is very likely to be in competition with other foundries and, while the jobbing business may be desirable

to make up tonnage, and work the foundry economically, any decision to take business of this kind or let it go should be made only on the basis of accurate information as to what it actually costs and what, if anything, the foundry will lose from unearned burden, as discussed in Chapter XII, if the outside work is dropped.

CHAPTER XVII

TEXTILE COSTS

Many things contribute to the efficiency of textile mill management. When a business is small, its success usually depends on the ability, foresight and good judgment of one or two energetic men. As the business grows, methods and system must more and more take the place of the manager's personal oversight, and the need increases for accounting, sound in principle and simple in operation.

Many textile mills still have an accounting practice that operates on the principle of an old-fashioned "merchandise account"; that is, there is an inventory or stock-taking at the beginning of a fiscal period, purchases and operating costs are charged and the sales credited during the period, and only the taking of another inventory reveals in any conclusive or accurate way the profits which the business has earned.

In contrast to such a practice, modern industrial accounting records the transfer of values from an inventory of raw material, combined with

labor and burden, through what is commonly called "work-in-process" to an inventory account for finished goods, and finally to cost of goods sold; all with appropriate subdivisions (for grade, size, patterns, etc.), to make this kind of a record easy to keep, and as useful as possible to the operating officials of the mill.

The things of primary importance in textile accounting are adequate stock records, the accurate distribution of expenses, and cost accounting that includes all the elements of costs and may be proved with the bookkeeping, monthly, quarterly or at the close of the year. Such accounting is a help to efficient management, not only as it traces and records values, but also as it may be made a powerful agent for production control.

It therefore follows that the accounting structure should to some extent parallel the mill organization; that is, the material used, the labor and expense in the several departments, and the production, should be so reported that it will appear regularly whether the policies of the management are being carried out by the superintendent and overseers, and just how much has or has not been accomplished by the head of each department. Proper reports should relieve the mill manager of details, and at the same time so visualize

conditions that his personal effort may be felt wherever and whenever necessary.

Plant Accounts

Many textile mills work on a wrong principle in handling their accounts for plant and equipment. In times of prosperity the values of the plant are written down, or important additions are made without any corresponding increase in the book values. This may be conservative, but it is wrong in principle and often bad policy, as many a management has learned when it became desirable to make a favorable showing of plant values in connection with the issue of new stocks or bonds. It is furthermore true that unless some accurate account is kept of plant values, the management does not know how much plant or equipment is devoted to a particular department and therefore what the real costs of manufacturing are.

On the other hand, if the business is not prosperous, frequently no provision of any kind is made for depreciation, although it must be admitted that buildings and equipment deteriorate. They may be kept in repair, and for a long time they may be as efficient in use as a new plant, but the time will come when it will not be good policy to make any more repairs; either because the gen-

eral deterioration has been so serious that repairs will not restore the original efficiency of the plant, or because it is no longer as well adapted to the business as a newer type of building or machine. Sometimes the plant has to be abandoned for a new location. In some industries there is a peculiar danger that equipment will become old-fashioned. In other cases the course of deterioration is very rapid; but always, without exception, there should be an intelligent provision for depreciation. See Chapter VI.

Accounting for Current Assets

Cost accounting, however, has to do principally with the value of current assets and their transformation from inventories of raw materials through work-in-process to finished product.

If the industry is small and the product uniform, as, for example, a mill in which the entire product is grain bags of one size and quality, the inventory requirements may be met very well by a thorough, honest stock-taking once a year, or once in six months, and the cost accounting by a practice which divides the value of material consumed, the total cost of labor and the total annual overhead expense, by the number of bags produced, using the resulting quotients as the cost per bag for each

of the three elements. The conditions are the same in a mill making any standard goods like 3-yard sheetings, or exclusively a count of 65 yarn, and there are many other illustrations of the same principle. Cost accounting for an *absolutely* uniform product is an extremely simple matter.

If the business is large, however, and the manufactured product diversified, made at varying costs, held as finished product varying lengths of time, and sold under differing conditions, this simple accounting is by no means adequate.

An adequate cost accounting practice must follow the goods with as much precision as possible, accumulating data as the work-in-process moves from department to department, and concluding with a cost of finished cloth made up in detail of the costs of the successive operations through which the product has come.

Manufacturing Burden

The main elements of burden in a textile mill should be developed and distributed to departments as outlined in Chapters V to XIII.

Within a department there may be one or more production centers, corresponding to operations, such as carding, spinning, quilling, warping; or different groups of looms, if the mill has different

sizes or different makes. The equipment in each production center represents an investment of capital; it requires the payment of taxes and insurance; it suffers depreciation (even more rapid than the building), and it incurs charges for power, repairs, and such indirect items as superintendence, inspection, and helpers' services. If the mill shuts down, the power may be shut off and the overseers and second hands dismissed; but so long as it runs, however short handed, or however inefficient, these charges do not change materially; and the important items of interest, taxes, insurance, depreciation, etc. (with the possible exception of repairs) are not one whit less.

All that has been described so far is overhead expense, more properly termed *burden*,¹ and does not include any labor applied directly to the product (like that of the operative who is dressing warps or tending a loom).

This great accumulation of burden *represents manufacturing capacity*. Each department, or if the calculation is carried to details, each dressing wheel or loom, has a known annual burden. Its cost per hour is determined by dividing the total burden by the hours in the working schedule, and

¹ See footnote, page 11.

the shorter the schedule, the greater the hourly cost for burden.¹

With the buildings completed and the equipment installed, the management is ready to hire operatives and start the raw material through the mill. The fabrics are designed, the yarn spun or purchased, some of it is dyed, the warps are dressed, the filling is wound, the loom brings the warp and filling together, and the completed cloth goes through the finishing room, and perhaps the dye-house, to the shipper. Throughout its course, the yarn and cloth have absorbed successive increments of direct or productive labor, and of the burden pertaining to the production centers through which they have passed.

The difficult part of cost accounting is to get a correct distribution and application of overhead expense or burden. Very few mills have calculated the burden element in cost with any degree of precision.

Correct Burden Distribution

A textile mill presents striking opportunities for the correct application of burden according to two plans that meet this test in every way.

¹ In a shorter day, nevertheless, there may be a real increase in total efficiency and net profits.

Weaving labor, for example, is usually paid for at piece rates, and the corresponding burden, properly understood, is a *rate for the loom, just as definite and just as easily charged to cost as the labor of weaving*. A machine rate, correctly calculated, has the characteristics of a royalty charge, such as a shoe manufacturer pays on leased machinery. The analogy is remarkably close, except that the royalty does not include the expense incidental to space, power, or supervision. Anyone who has appreciated the simplicity and precision with which shoe manufacturing labor and burden costs are calculated (the material cost is far from simple) will understand the great advantages of getting a method equally simple and reliable for textiles.

Some textile processes, however, cannot be handled in this way. Dyeing, for example, is almost uniformly paid for as day labor. The employees often divide their time in too much detail to be made a matter of record; and the dyehouse burden, although clearly identified as belonging to this department, cannot be applied to the individual fabric any more easily than the dyehouse labor. Under such conditions the burden and labor are merged into "a process rate," and charged to the manufactured product on the basis of unit costs.

This last example illustrates the fundamental importance of correct burden distribution, namely, that it identifies burden charges with the manufacturing process (carding, spinning, dyeing, warping, weaving, etc.), to which the space and equipment are devoted. Only when burden is distributed in this definite way to each department, or each operation, can a mill owner or executive know the real cost of successive steps of manufacture; and only when the costs are known step by step is it possible to speak with confidence of the total.¹ Once the burden is allocated, it may be applied to the manufactured product either as a machine rate, or a process rate; or for the sake of simplicity, in dealing with unimportant totals, by older and less accurate methods.

Standards

Every manufacturer has in mind more or less definite labor standards—how many yards, pounds or pieces his operatives should complete in a given time. When such standards have been carefully established, they may be used not only as a guide to productive efficiency, but the cost accounting may be reduced to such totals by classes, as will

¹ If the product is *absolutely* homogeneous, like grain bags or 3-yard sheetings, this statement does not apply.

prove from time to time that the normal or standard costs previously determined are being realized in actual operation.

For most textile mills it would be a great step forward to consider standards of output not merely in terms of labor cost, but rather in terms of inclusive cost. Burden is frequently more costly than labor. That is a statement which may not hold true beyond criticism in the textile industry, but in the other industries burden is sometimes twice the labor; and even when they are of only equal importance, a five per cent gain or loss in efficiency means twice as much in dollars and cents, if the reckoning is made including burden. Many manufacturers are now half-hearted in their critical inspection of operating efficiency because the manufacturing statistics that come to the manager's desk usually fail to measure the loss or gain accurately. They are thus regarded as indicating only a tendency, to be encouraged or corrected, rather than definite failure or success in utilizing manufacturing resources worth so many dollars per day.

Measuring Loss from Idle Equipment

It is essential to distinguish clearly between losses or gains on fabrics actually made and sold,

and losses due to slack production or inefficient use of equipment.

It must be borne in mind that the finished product of a textile mill has **absorbed only the burden of the equipment actually used in its manufacture.** It has not absorbed the burden of unused equipment or idle machinery. If the mill is equipped to do its own spinning, and the management decides to purchase yarn, the idle spinning frames have contributed nothing to the product. It is obviously unfair to charge into the cost of goods the burden charges on the dyeing department when the goods are not dyed. If the volume of dyed goods has dropped to nothing, certainly the white goods have not increased in cost. If only three-quarters of the looms run, the idle remainder have not helped make the pieces of cloth actually manufactured, and although the mill may go into bankruptcy because it cannot utilize its equipment, **the cost of the fabrics actually made is not greater on that account.**

The burden on idle machinery is no more a part of the cost of manufacture (unless due to enforced seasonal variations) than the burden on a mill owned by another corporation. When there is a proper distribution and application of expense burden, only that burden is charged to cost which

represents the equipment utilized in manufacture, and burden not applied remains as a balance to be charged direct to the Loss and Gain account at the end of a month, six months, or a year.¹ For any management to know how much is lost in each department through idle machinery or wasted capacity may be more important than the exact knowledge of inclusive costs already discussed. It is another phase of that careful scrutiny of industrial efficiency so indispensable to successful management.

Effect on Sales Policy

If the distinction is maintained between losses or gains on goods made and sold, and losses due to restricted output, the management will consider sales policies in a much more certain way than is ever possible when the facts are obscured in the haze of average costs, calculated on varying volumes of product. In respect to burden it is frequently true that costs figured as averages vary beyond all hope of comparison as the volume of output goes up or down.

When a cost accounting practice is maintained that distinguishes carefully between prime costs

¹ For a more detailed discussion of this subject, see Chapter XII.

for material and labor (which vary almost directly with the volume), and overhead charges or burden, the mill management can see exactly in times of slack production at what price they can take any line that is offered and get something to carry the burden of the mill, in addition to the direct cost of labor and material. This, it must be admitted, is to some extent a matter of policy, for a mill may decide to hold its price and restrict its output, rather than break the market by quoting prices that will give them temporarily a little additional profit.

Although textile mills are primarily industrial establishments in which the attention is fixed on manufacturing, good merchandising often plays an important part in the success of the business. It cannot be known positively what is good merchandising unless attention is given to such considerations as have just been named.

Fixing Responsibility Between Mill and Selling House

Good accounting is helpful to the sales policy of the business in other important respects. Textile mills that are not making an absolutely standard product must plan selling campaigns in co-operation with the selling house, or on the advice of their own selling organization, with the idea

that a product made at a calculated cost may be sold on prices and terms that may be forecasted with more or less accuracy. Under such conditions, it is of the utmost importance to remove all occasion for dispute between the mill and the selling organization as to the responsibility for the success or failure of such a plan, and what is more important, to fix definitely the responsibility for any failure that there may be to realize expectations. This highly important result may be secured by an accounting device which gives the mill definite credit for its own performance, credits the selling house for the net results of actual sales, and also charges against it any losses which result from a failure to realize nominal prices. Under some circumstances, this feature of a modern accounting practice may be the final step necessary to secure the harmonious and successful management which is the ideal in all business operations.

Analysis of Sales and Profits

When the mill management has detailed costs, they can know the margin of profit between sales and manufacturing cost on each class or grade of product. The results will then be shown, not only as a total gain or loss on sales for the season, but as an analysis of operating results on which the

management can select with certainty the more profitable products. Detailed costs are indispensable for accurate estimates on new lines of goods so that the management may avoid the mistake of taking on styles or lines that will not pay a profit.

Not only will a more exact knowledge of costs help a mill management to direct the attack of the selling force on the market, but when a mill is selling a variety of product at various margins of profit, it is not merely the amount that a salesman sells, but rather the *amount of profit on his sales* which is really important to his employers. This distinction becomes important in a large selling organization, and of course it cannot be made effectively except on a very exact and reliable knowledge of manufacturing costs.

CHAPTER XVIII

CANDY COSTS

Candy manufacturers have been accustomed to regard their business as "peculiar," and have professed to believe that it did not afford the same opportunity as other industries for the effective application of modern cost accounting principles.

When we consider the industry in a broad way, we find that candy is made in many comparatively small factories, as well as in the huge plants which are characteristic of other lines of industry. As a natural result, competition is very keen, and some of it not as well informed as it should be, largely because a man starting in business with small capital has not as much experience as a man who has accumulated and is using the larger investment. A second important consideration is that most candy manufacturers are making a great variety of product. There is thus grave danger that a business, profitable as a whole, may be carrying one or two lines which, if their true costs were known, would be shown as *subtracting*

from, rather than adding to, the total profits of the business.

Many concerns still have an accounting practice that operates on the principle of an old-fashioned "merchandise account"; that is, there is an inventory at the beginning of a year, purchases and operating costs are charged and the sales credited, and only the taking of another inventory reveals in any conclusive or accurate way the profits which the business has earned. This information is of practically no assistance in showing *which lines* have been handled at a profit and which at a loss. When candies that sell from five or ten cents a pound up to forty or fifty cents are made in the same department, and often on the same machine, it is absolutely necessary that a reliable method of figuring costs be used in order to make sure that *all* these lines are profitable. Only then will the manufacturer know which lines are most worth while to push, and on which he can afford to spend money for advertising and selling expenses.

Success in the candy business, furthermore, frequently requires something more than the right product made at the right cost price. With the selling cost in the business increasing in comparison with the cost of production, it is of the utmost

importance that every sort and kind of selling cost should be carefully separated from the direct cost of manufacturing.

For some kinds of trade there are heavy additional expenses for packages and containers of various kinds, and it is particularly important that these costs should be kept accurately and entirely separate from candy manufacturing. The manufacturer who makes his own boxes and does his own printing is in competition with more or less similar supplies which he might purchase from outsiders, and he should know at all times how much he gains or loses by having the work done in his own factory.

Schedule Costs of Materials and Labor

The cost of candy, as of any other product, is made up of material, labor and burden. In many industries the rule should be followed of manufacturing well defined lots, or orders, and collecting the actual cost of each order for material, labor and burden as accurately as circumstances will permit. When this principle is faithfully observed, and the bookkeeping carefully done, the product of the factory has then absorbed all of the manufacturing cost.

It is hardly possible to apply this rule generally

to the manufacture of candy. It may be done in the case of large lots of lozenges or wafers, or possibly on some other kinds of hard candy, but generally we must depend upon an entirely different principle to get reliable costs of the various products.

Almost all candy is made on a formula, and accuracy in mixing the ingredients is an important consideration in getting a satisfactory product. It is therefore possible to make a schedule of the material contents of any kind of candy manufactured in the factory, which will probably be more reliable as a basis of calculating costs than the weights which would be reported of materials drawn on requisition. If proper care is taken, from time to time, to check up the results from operating on these schedules, a manufacturer will have very satisfactory information as to the material cost of his product.

If piece rates have been established, labor costs can be reckoned in the same way and just as accurately. Even where wages are paid on the basis of day work, the calculation of average daily production for each employee will give unit costs which are reasonably satisfactory. It is of the utmost importance that labor and material costs, however calculated, should be checked up very

closely each week by comparing the total estimated labor costs in each department with the total productive payroll, and the total estimated material costs with the quantities drawn from stock.

Base Price for Materials

As in other industries, the market prices of the raw materials used in making candy fluctuate considerably, and the plan here proposed for taking care of this fluctuation is equally applicable in many lines.

When scheduling the material cost of a standard batch of candy, the quantities are of course known from the formula, which is scientifically worked out to give uniformly the best results. If the raw material prices were fixed it would be a very simple matter to calculate the cost of the batch, and of all batches made, and the total would agree almost exactly with the value as well as the quantities of the materials drawn from stores. The most important raw material, sugar, fluctuates from month to month, from week to week, and sometimes from day to day, and while minor fluctuations can be disregarded, any considerable increase or decrease must be reflected in the cost, and if maintained will in most cases be reflected in the selling price also. It is important to record

these fluctuations, first, to determine the effect upon the selling price, and second, to keep the cost up-to-date.

This can be done by calculating for a finished batch of candy, which will be made up of various original and secondary ingredients, the proportionate amount of the original ingredient in a batch, say of 100 pounds. A sliding scale of cost prices is then figured to show the difference in the cost that will result from an increase of say one quarter of a cent a pound on sugar. This table can be made to cover several fluctuations, in fact as many as are likely to occur, and after it is once figured out, there need be no recalculating unless there is a change in the formula.

Distribute Burden Correctly

The most difficult, and indeed the most important problem to be solved in ascertaining satisfactory costs for various kinds of candy is the distribution of overhead charges or burden, which may comprise one-third, or even more, of the total cost of the product. The mistake is often made of assuming that burden has some fixed relation to the material or labor elements of cost. The most that can be said for a calculation of burden as a percentage of labor entering into the cost is

that it is a simple way to make the calculation. If several varieties of product are made in a department where the employees are paid about the same rate of wages, and the various products require nearly a uniform amount of labor, a fairly accurate distribution of overhead or burden will be secured by reckoning it as a percentage of direct labor cost.

Conditions, however, are not as simple as this in many departments and almost never in a candy factory as a whole. Large and costly machinery is used in some departments and not in others, on some products and not on others, and any plan which fails to take account of these differences is sure to bring out cost figures which are far from accurate. For example, the cost of chocolate dipping by hand should not carry the same *burden* as when this operation is done on the enrober, although the enrober, like other semi-automatic machinery, saves in direct labor many times the additional cost for the fixed charges of burden.

Before proceeding with the explanation as to how the costs should be calculated if they are to agree with the facts, it should be pointed out that it is even less satisfactory to reckon overhead or burden as a percentage of the combined material and labor costs. The material cost of candy varies

very widely with the grade and character of the material used. It does not follow, however, because the material cost of one confection is 18 or 20 cents per pound that the burden on that product is any more than that on a product in which the material cost is only 9 or 10 cents per pound.

Most of the elements of burden vary with the time required for manufacturing. Assuming that the labor cost is the same on these two products, and that the overhead is added to both on the basis of a percentage of the combined cost of labor and material, a greater burden is thereby added to the higher priced candy than really belongs to it. It may be that the profit is sufficient to take care of it. But does the manufacturer want to sell the cheaper goods at a loss? When there is charged to the higher grade goods some part of the burden which belongs to the lower grade, the resulting calculated costs are below the actual costs. As the margin of profit is usually small on this line of product, it is extremely dangerous not to be sure that the burden is properly distributed.

Burden

The main elements of burden for a candy factory should be developed and distributed to departments as outlined in Chapters V to XIII.

In every department there are additional indirect costs such as labor of foreman and helpers, and special charges for gas or steam heat, and in chocolate departments and factories, for refrigeration. Although these elements of cost may be neglected or not stated, they are, nevertheless, taking their proper share or more of what is figured without them as gross profits.

There are other charges connected with the management of a candy factory, which are not necessarily well expressed through the departmental burden. Such are charges for administrative salaries, bookkeeping, cost accounting, superintendence, medical inspection, lunch rooms, and the general charges of management not specifically and directly connected with the operation of the several departments. These are charges which in a small factory should be applied in a fairly uniform way over all the product of the establishment, probably on a per pound basis. This charge may be known as general burden, and since it is uniform, it may be applied to the cost of each kind of product with very little additional work.

This use of general burden should be carefully distinguished from the objectionable practice of throwing important elements of indirect costs together in a "general expense" account, concealing

the leaks and wastes that reduce efficiency and curtail profits. Many manufacturers have no doubt been satisfied to handle burden in vague and general terms because they have not known of any better way to dispose of it.

Make Division Between Departments

In a large factory, there is usually a distinct division between departments, and the costs can readily be accumulated for each separate manufacturing process, such as grinding cocoa beans, preparing coating, mixing material for centers and dipping. There is first the cost of the materials which make up the confection. This can be determined very accurately from the formula (which must be carefully followed if the product is to be right), and the use of base prices as outlined on page 246. The cooking of the materials, the melting, casting and cutting may all be kept separate, and the overhead or burden charge for each of these operations, or the department as a whole, must be added to the labor and material to give the total cost of a certain kind of product.

In the cost calculations, it is of course necessary to make a fair allowance for the increase in the weight of materials, due to the water which is added, and the decrease due to the small amounts

of waste in the different operations. There will be also a credit for the scrap made in casting or cutting, and the final result will be the total net cost of a certain number of pounds of hard candy or centers ready for dipping. The necessary information can be obtained from the production records which are now kept in most factories.

The next operation in making chocolates is the dipping of the centers. The principal cost of dipping is the cost of the chocolate and this will be accumulated on a separate record, showing the labor, material and burden cost of the chocolate of each mixture and grade. The cost of the centers as already figured, plus the chocolate, will give the total material cost of the finished candy. From this total will be deducted the centers scrapped in dipping, and to this net material cost will be added the labor for dipping and the burden. The different methods of dipping or coating illustrate the necessity of making an accurate distribution of the burden, as some chocolates will be dipped by hand and others on the enrober, with less labor but a greater burden charge.

Separate Packing Costs

After hard candy has been cut or the chocolates have been dipped and cooled, we have what is

really the flat manufacturing cost. There are additional expenses, however, for finishing practically every kind of candy, as it is packed in boxes, jars, kegs, pails, tins, etc., using papers, seals, ribbons and labels. A schedule of the finishing specifications and cost may be used in figuring the cost of the finished package, just as a schedule of the material may be used in making a calculation of the material cost of the centers as already explained.

In addition to the packing material, there is the labor cost of packing; that is, packing, wrapping and sealing, tying and labeling, and bowing, together with the burden for each of these operations, or for the finishing department as the whole, depending upon the size of the factory and the method in which these operations are carried on.

The bulk cost of the candy ready for packing, plus the finishing materials and labor, less the deductions for seconds, is the final finished cost per pound and per package. The bulk cost of mixtures is the total of the bulk costs of the individual pieces in the mixture. These costs vary greatly, and as some of the pieces cost more than the average selling price of the whole, the make-up of each mixture must be accurately calculated.¹

¹ See page 245.

Do Not Estimate from Tests Only

Many candy manufacturers have worked out a system of estimates, and have made test runs of new lines of candy, as well as several tests a year on each of the regular lines, to check up the costs from which their selling prices have been figured. Few manufacturers have attempted to check up costs weekly and monthly with the actual results as shown by the bookkeeping: that is, the consumption of materials and supplies; the labor paid, both direct and indirect; and the general expenses of the business. Test runs, no matter how carefully made, are merely an indication of how work is being done. Employees are considerably more efficient when they are under observation during tests, than in their general work, when they know that no definite records are being made of their performance which will be finally figured out as part of the costs.

Prove the Scheduled Costs

The plan already suggested of scheduling the cost of materials from the formula, and of labor from piece rates or day rates divided by the estimated production, will make it a simple matter to figure out the cost of each lot of goods at the scheduled price. Production at these calculated

costs will be credited to an account which has previously been charged with the actual consumption of the materials and the actual direct labor from the payroll, together with the burden of the department. Any differences in the material or labor accounts will represent either work-in-process or a slight variation between the estimated and the actual costs. If these variations are large, the estimates should be checked up and revised. Variations in the burden accounts have the special significance explained in Chapter XIII.

This constant verification of the estimates with the actual results in all of the departments is of the utmost importance to the management. The manager then knows exactly what is happening in all the departments of the factory, and can be sure that the costs as figured are substantially correct and may be relied upon in fixing selling prices.¹

The method of checking up the accounts, currently, gives not only the advantage of the test run but the added advantage that these estimates are in total checked up with the bookkeeping. It is not necessary to wait for an inventory in order

¹ The same principles, of scheduling costs and proving them in total with the actual figures, are being used in a large number of different industries with exceptionally good practical results.

to find out (from the Profit and Loss account) whether the regular performance of the factory averages near enough to the work on test runs to yield a total profit equal to the estimated margin between costs and selling prices. Very often a manufacturer has carefully kept a memorandum record of costs and confidently believes that he will make a profit at the end of the year of, say, \$25,000. When he takes an inventory and finds that this is reduced to \$15,000 or less, he then has no way of looking back over the year's work to put his finger on the exact sources of the waste and inefficiency that have crept in to cut his profits in half.

CHAPTER XIX

PAPER MANUFACTURING COSTS

The basis of good cost accounting is analysis. This is especially true in a paper mill where the analytical method is used in two distinct ways: First, when we recognize that paper making is made up of many distinct operations; and second, when we separate burden into its elements and consider each element in applying the burden to the product manufactured.

The Cost of Half-stuff

As examples of the many operations: Rags are taken from storage, thrashed, sorted, inspected, cut and dusted. They are then cooked for several hours, after which they are washed and bleached and finally run into a drainer.

This entire chain of operations is directed solely to making one of the components of paper commonly known as "half-stuff." In tracing the manufacturing operations thus far, we have passed by another subsidiary process, the manufacture of bleach.

If we are considering paper making from wood pulp, there is the long chain of mechanical and chemical operations resulting in the sulphite or soda pulp, which is as distinct a product as if it were manufactured in another plant. For each operation the cost should be determined, including labor, chemicals and supplies used in the departments, and burden. As to rags, this can be done lot by lot, showing what proportion sorts to grade, how much and what kinds are sorted out to be sold or used later, and the cost of the successive operations on each lot from thrashing to the drainer. The cost of wood pulp is the sum of the unit costs of the successive processes by which it is made.

The Cost of Rough Paper

When a furnish has been prescribed for any paper, it may include not only half-stuff and one or more kinds of wood pulp, but rosin size and color, and then as the product moves from the beaters to the stuff chest, through the refining engine, and on to the paper machines, there is completed another fairly distinct stage in the manufacture. Here "broke" begins to appear for the first time, and it is a very important factor to be reckoned with, whether it is returned to the beaters in the same or a later run.

Finishing Costs

The rough paper from the machine may be finished in many very different ways, being dried on the machine or by any one of the several "loft" methods, then plated, calendered, cut, sorted, counted, trimmed and sealed. After the paper has gone through one or more of these various operations, packing and shipping are still to be considered.

Each of these operations, from the furnishing of the beaters to the shipping of the finished product, is a manufacturing unit, having a special duty to perform and a special method of performing it.

Just as any factory takes in its so-called raw materials, which are, with few exceptions, merely the finished product of some other plant, so these paper manufacturing units take in as raw material the finished product of a previous unit, and, after performing certain operations upon it, and perhaps adding certain other products to it, pass it on as their finished product, to become a raw material for the succeeding unit.

These units, or departments, are distinct from each other, occupy different space, use different machinery and labor, materials and supplies, and are under different supervision. They will there-

fore have widely different degrees of efficiency and widely different charges against the product,¹ which must be kept separate in all correct paper mill accounting.

Power Plant and Repair Department

The analysis of the operations should not be limited to the departments that turn out a tangible product, but should be applied to the power plant which provides steam and power to the other units, and to the repair department which supplies services and repair parts. Every department using steam or power should be charged with its correct proportion of the cost of operating the power plant; and every department having repair work done should be charged, not merely with repair materials and the wages of the repair men, but also with a fair proportion of the expense of operating the repair department, just as an outside company would add something to the wages of their men to cover the cost of their shop. The cost of every repair job should be recorded and charged to the department in which the work is done, so that the man who is responsible for the efficient operation of the department will constantly watch the repair charges.²

¹ See page 173.

² See page 146.

The consideration of the power plant and the repair department as individual units is a necessary preliminary to the calculation and distribution of overhead charges or burden, so that they can be logically and accurately applied to the product as it goes through the successive manufacturing operations.

What is Burden?

A paper manufacturer is usually a landlord as well as the manufacturer. He is a land owner, a tax payer, and must take over all the expenses of the landlord just the same as if he paid them indirectly through a rental. Probably he also becomes a manufacturer of heat, power and light; therefore, unless the various functions are analyzed and the expense of performing these functions determined, before applying it to the cost of the paper, how can he tell whether he is not making money as a landlord and losing it as a paper maker? How does he know that he cannot purchase power, heat and light cheaper than he can produce it?

Cost accounting in a paper mill really becomes very much simpler after such an analysis has been made, and the departmental operations not only clearly recognized, but the burden which belongs to each properly distributed. This should be done

by apportioning land and buildings charges to the several departments on the basis of area occupied, and fixed charges on equipment in proportion to the value used, as described in Chapters VI to XIII. There are also the charges for power, repairs and supervision—all part of the burden, which is a specially important factor in paper mill costs. If costs are to be accurate it is necessary to make sure that *all* expenses of this character are not only recognized and distributed, but that they are actually charged in full to the various products of the mill.

Efficiency in any factory, mill or shop, is wholly a question of getting a suitable return for the expenditure, and the results from each department cannot be measured unless there is charged to each and every department, not only the payroll, but also the proper proportion of fixed charges, as above described.

Inventory Costs

Paper mills have a very considerable cost for carrying inventories, as discussed in detail on pages 98 and 104.

It may be the best possible business policy to take in a big stock of raw material, either pulp, rags, or chemicals, according to market conditions

and available sources of supply. But as previously noted, it is a costly undertaking to carry such inventories, and if, as frequently happens, certain kinds of raw materials are carried with reference to their use in particular kinds of paper, the cost of carrying (storage charges, interest and insurance on the investment, etc.), should be carefully assessed against the inventories in question, and thus ultimately against the particular grades of paper for which the stock is carried.

The diversity in policy among paper mills in respect to carrying stocks of finished merchandise affords another illustration of inventory costs which is too important to be ignored. The author knows two manufacturers of writing paper whose mill capacity is about equal. In one mill the policy is to carry a large and varied stock of sizes, weights and colors, ready for immediate shipment. The very diversity of the stock, and the need for convenient access, require a large amount of storage space, and of course the value of the stock and the carrying charges thereon are considerable.

In the other mill the selling policy is entirely different, as it operates almost exclusively on jobbers' watermarks, so that its manufacturing follows instead of precedes the customers' orders,

and there is a relatively small finished stock on hand in the mill at any time. This stock, moreover, is of such a character that it can be stored in the most compact way, thus diminishing the storage costs in respect to room required, although not in respect to fixed charges on the value.

Unearned Burden

Many manufacturers are accustomed to say that when the volume of production diminishes, the average or unit cost increases. On the contrary, if production falls off, because of poor business conditions, the burden should be absorbed only in proportion to the product that has actually been manufactured.

A three-machine mill, for example, finds it necessary, owing to lack of orders, to shut down one machine for a week. Throughout the month this machine has been running at a high degree of efficiency, producing a grade of paper which cost, let us say, 5 cents a pound, but had previously cost $5\frac{1}{4}$ cents a pound. If there is loaded on to this 5 cents cost the fixed charges of the week when the machine was idle, it might raise the cost to 6 cents a pound. The cost of the paper made during the three weeks when all three of the machines were running was not actually any greater because one

machine was later shut down for a week, any more than the cost of the paper made on the two machines which continued to run was greater because of the shut down of the third. **The unabsorbed burden for the week represents unused capacity and is a direct loss that cannot justly be loaded onto the reduction costs of other machines, or other weeks.**¹

This method, of including in the cost of the product only the amount of burden that it has actually used, is not only correct in theory, but it has several very practical advantages. First, the costs are made up on the same basis at all times, and a comparison of similar runs gives a fair measure of the efficiency in the several departments. (When an attempt is made to absorb all the burden each month or period, the comparative costs may lose all significance because of the variation in production.) Second, the inventories taken at cost prices will be on the same basis each year, while with the other method the inventory at the end of a poor year would be loaded with a higher percentage of burden, which would partly obscure the poor results and then make the next year absorb part of the loss in the apparently decreased

¹ For a more detailed discussion of this subject, see Chapter XII.

margin of profit between the loaded costs and the selling prices.

Cost Accounting and Efficiency

Comprehensive cost accounting, appropriate to a paper mill, is a positive help to efficient and economical manufacturing. Since raw material is one of the fundamental elements of cost, factory accounting at the very beginning provides for the control of inventories, insuring that the investment in stock of various kinds is kept at the economical minimum. The stock clerk, at the same time, is responsible for keeping the quantities of various items at the proper balance to supply manufacturing needs efficiently. When the cost records are "tied in" with the general accounting, the management has complete control not only over the operating expenses of the factory, but also over the investment in current inventories of raw material, work-in-process and finished product.

A cost accounting practice, including burden charges carefully analyzed and applied, not only provides for an accurate determination of the cost of the product, but it also enables the management to compare different ways of making the same or a similar product. They can determine on which machine their various orders will run to the best

advantage, with a minimum of broke and shrinkage, and a maximum of production. They can find the point on each order where greater speed is no longer an advantage, where the loss due to breaks would offset the gain due to increased production. They can determine the best furnish for each grade, by noting the effect on the cost sheet of each change of furnish, as compared with previous runs of the same grade. Incidentally, they may discover that an apparent saving in the cost of the furnish is often nullified by its effect on the speed with which the paper can be run, or on the broke and the shrinkage.

Accurate Furnish Costs

How can one tell the exact effect on the cost of a given paper from putting more or less wood pulp or rag pulp into the furnish unless he knows as accurately what the rag pulp has cost, as he does the cost of the wood pulp which is purchased outside, ready to put into the beaters? Dependable costs are particularly important in a mill where half-stuffs are made and used. The raw stock passes through a number of processes, each carrying more or less heavy burden charges. Varying losses occur during certain of these conversion processes, and unless all labor and burden

charges are applied, and an accurate knowledge of yields obtained, the half-stuff will frequently go into the beater, as one of the constituents of paper, bearing a fictitious value. The general tendency is to undervalue this stock at the beaters, where it is combined with pulps whose value is definitely known. Therefore, the greater the quantity of half-stuff consumed, and the more varied the combinations in which it is used, the more urgent the need for sound costs.

The cost records will show at once whether a more expensive material has been charged into the furnish than was ordered, whether greater quantities of some of the materials have been used than were ordered to make a given grade and weight of paper, and whether the estimated yields from different raw stocks agree with the actual yields.

Departmental Costs

Having made the analysis which is essential to get the successive subdivisions of manufacturing operations in a paper mill, each and all of these operations will show a cost (labor, supplies, and burden used or "earned") that goes up or down according to the various circumstances affecting production, but depending chiefly upon the skill

and energy of the superintendent and his foremen.

Paper making is an industry of skill, requiring in some respects highly technical chemical tests, which, in turn, depend for successful operation on accurate records of time, temperatures, pressures, etc. All will agree that the control of mill chemistry depends upon having these records in trustworthy form. Accurate cost accounting not only requires adequate records, but when these records are kept and the costs are known, an intelligent manager will immediately use them to increase the efficiency of the departments.

These records, when accumulated over a reasonable period, will set standards for production, which can be used as bases for comparison of future operations. When a new order is to be run, the best previous order of a similar kind and grade of paper should be set up as a standard to see if the men on the machines cannot beat the former production and decrease the cost. If handled in the right way these cost and production records become very valuable aids to the foremen in running their departments economically and efficiently. A dependable record, moreover, is one of the essentials for fair dealing between management and employees.

Production Reports

The cost and production reports also bring close together the control of materials and the control of operations.

The management will know, for example, exactly how long the various kind of rags were in the bleach boilers, how long in the washers, how much substance was lost between the weight of dry rags and the fiber finally deposited in the drainer, how much of this half-stuff, and the pulp to go with it, was put into the beaters, how much sizing and coloring matter was used, and finally how much of the furnish emerged as salable product. Some paper manufacturers, who have done but very little in the way of cost accounting, have excellent records of this kind, and when this is true, what a pity it is that these records are not used, with the very little modification which they probably require, to bring out reliable costs of the several operations.

The same production reports, properly arranged, serve as a basis for the efficient supervision of labor. Cost accounting in respect to labor charges consists primarily of reporting correctly the orders and runs on which the work has been done, or the expense or other special accounts to which the payroll should be charged. It is es-

sential that the accounting should carefully separate manufacturing labor costs and labor costs due to the numerous kinds of accessory work carried on at the plant. Only when such additional elements of expense are carefully separated from the current cost of manufacture can the productive departments be held strictly responsible for the results obtained from a given payroll expenditure.

In most cases it is tremendously important that the results should be reported promptly to the factory superintendent, to the foremen, and in some instances, to the workmen themselves if the efficiency of the factory is to be kept up to a satisfactory standard. Some surprising results have been obtained from the use of labor records which gave the management prompt and reliable information as to what each workman in the mill was doing. Production is frequently increased simply from the moral effect of having the records.

Danger of Tests and Averages

There is an amazing inaccuracy and the gravest danger of wrong information in much of the so-called "cost finding" still in vogue in a great many paper mills. Some manufacturers, for example, estimate the cost of different grades of paper with a great deal of care, and feel very comfortable in

regard to the accuracy of these estimates, because when multiplied by the quantity of each kind of paper made, they account very nearly for the total cost of mill operations during the year. Even in paper mills where this kind of cost calculation has received a good deal of attention, a really analytical cost practice showed that the calculations contained serious errors in regard to some of the important products in the mill, an error of calculating costs on one grade being partially offset by an equal or greater error in calculating costs on another grade.

Combining facts that really differ gives a meaningless average. When a paper machine can produce thousands of pounds more paper in a day on one grade and weight than it can on another, there is little to be gained by attempting to average facts which are significant to a management only when their exact variation is recognized as accurately as possible. Finishing costs vary tremendously, and when the cost of packing and shipping is carefully separated from other charges in the factory, there are sometimes surprises in store for practical men as to the variations in cost of the finished product resulting from the different ways in which it is prepared for sale.

How to Use Averages

And yet average costs, which have just been mentioned as a danger to be avoided, are of the utmost importance under certain circumstances. It may seem at first sight that a carefully kept record of the results of a test run can be relied upon to guide the management in making a particular kind of paper, or in fixing the price at which to sell it. The fact is, however, that a test run may be seriously in error. Workmen under such circumstances are apt to perform very much better than they will under average conditions. It is quite possible, on the other hand, that they will encounter some obstacles which can be removed by a further experience with the product in question, so that the test run offers not only the danger of a performance at a higher standard than can be maintained, but also the unsuspected danger that the costs are higher than need be, because of the comparative unfamiliarity with the operation in question. It is particularly important in paper mill cost accounting to get averages on successive operations which are of a kind that will permit of averaging, not only for labor costs, but also for materials, in view of the great difficulty of determining the accurate dry weight of the half-stuff, and the wood pulp used in the furnish.

CHAPTER XX

THE RELATION OF THE COST DEPARTMENT TO THE FACTORY ORGANIZATION

When cost accounting is mentioned, most business men immediately think of a clerical department which is engaged in working out the cost of different articles produced, primarily that the management can tell at what price they can afford to sell each item of product. The author has found in practice that other aspects of the work of a cost department, while less known, are considerably more valuable to the average business. This chapter outlines some of the most important functions of a cost department, and shows how it may be fully utilized in a modern factory.

It should be made clear at the outset that the cost department deals with cost *accounting*—with debits and credits, different in character but the same in principle as the debits and credits handled by the bookkeeper in the sales and cash records. Cost calculations are sometimes made entirely detached from the general bookkeeping, but such records very rarely have anything like their full

value, and their use is always attended by the very considerable risk that they cannot be proved by the showing on the financial books at the end of the year or other closing period. Only cost records which are "tied in" with the general accounting records in the treasurer's office will give complete control over the operating expenses of the factory, and enable the management to know at all times how much is invested in raw materials, work-in-process, and finished product; and also to know the cost of the goods which are being sold.

A cost department, therefore, should not be engaged simply in cost *finding*,¹ but rather in cost *accounting*, which is much broader work and much more valuable to the management.

Material Costs

Cost accounts are so closely connected with the production in various ways, that it is the practice in many shops to initiate or authorize production

¹ It seems to the author that the use of the term "cost finding" by professional accountants or industrial engineers is either a confession of ignorance as to how the transfer or conversion of values in an industrial enterprise should be recorded, or an attempt to make prospective clients think a short cut has been discovered. There is no royal road to—sound industrial accounting.

by means of an order, either prepared in the cost department, or put on record there before the work is actually started. It saves time and tends towards accuracy to combine as closely as possible the operation of ordering out material for a particular job and the steps necessary to record the cost of that material.

The material is not only charged to the cost of product being manufactured, but it is also credited to the stock from which it is drawn. Cost accounting, therefore, at the very beginning of production is part of the plan for controlling inventory, to make sure that the investment in stock of various kinds is kept at the economical minimum. The stock clerk at the same time is responsible for keeping the quantities of various items at the proper balance for efficiency with due regard to the factory's use of the goods in question.

The control which the cost department, working with the production department, has over the proper use of materials is most important for every industry. In one factory, when the cost department and production department were put in working order, it was found that the stock of many parts was sufficient to last for more than a year, while there were none of others which were necessary to assemble the same machines. This condi-

tion is not unusual in large factories where there is no efficient cost and planning department. The result in the case cited has been a reduction of fifty per cent in the total investment in the stock of finished parts, while the manufacturing in some departments has been considerably curtailed and at the same time shipments to customers have been made much more promptly.

In another manufacturing plant the cost records which were "tied in" with the general books, showed an unusual consumption of raw material. Upon investigation it was discovered that a large run was spoiled and simply dumped down the sewer, without any report to the management. This waste would not have been detected if the cost accounting had not provided a careful check on the quantities used.

The formula in a certain paper mill called for a small percentage of expensive pulp and a large proportion of cheap stock. The cost records proved that the quantity being used did not correspond with the formula. When this was investigated by the management, it was found that the men were not carrying out instructions, and that the company was losing many dollars a day through the kind of materials being used.

In another factory, too large a proportion of

the materials was spoiled. When careful records of such losses were kept, the management was able to greatly reduce the extra quantity of castings which had to be made to fill an order and allow for breakage.

Labor Costs

As soon as manufacturing operations are started on the material withdrawn from the storeroom, cost accounting comes immediately to have a very definite and important relation to payroll, and payroll is removed only two weeks at most from the cash drawer. Efficiency in a manufacturing plant depends more or less on the *selection* of the material for manufacturing, but the term is ordinarily used to refer to the effective *handling* of materials with the most suitable equipment, men and methods, to make a salable product. The owner or manager, therefore, faces continually the problem of the quantity and quality of product secured from the expenditure of a given payroll, in connection with the manufacturing equipment or resources at the disposal of the employees.

Some large industrial establishments will have a fairly efficient payroll department and not much of a cost system, and occasionally in a large business there will be a payroll department quite inde-

pendent of the cost department, except that the operatives' records will be turned over to the cost department for entry after the payroll department has used them to calculate the amount due on the weekly payroll.

This detachment is unusual, however, and rarely feasible in small or moderate sized industries. The cost and payroll departments in a factory are, therefore, usually one and the same organization, presided over by the same directing head, and the work is carried on by the same clerks who handle production records from day to day as part of the cost accounting, and then frequently give their undivided attention to the making up of the payroll at the end of the week, when the last time slips have been turned into the office.

Cost accounting in respect to labor charges consists primarily of reporting correctly the manufacturing orders on which the work has been done, or the expense or special accounts to which the payroll should be charged. In a great many industries there are numerous activities carried on in addition to manufacturing itself. One industry, for example, may require heavy expenditures for experimental work, developing the product to keep abreast of competition, or to prepare for new markets. A long established industry, on the other

hand, especially one that has an extensive mechanical plant, is almost sure to expend a portion of its weekly payroll on construction and repairs of various kinds, from work on small tools to outright additions to plant, like the erection of new buildings or the manufacture of new equipment. It is essential for intelligent management that the accounting under such circumstances should carefully separate manufacturing operations from all of the accessory work carried on at the plant. Cost accounting cannot be at all accurate or satisfactory unless all such additional elements of expense are carefully separated from the current cost of manufacture, as only by so separating these elements can the productive departments be held strictly responsible for the results obtained from given payroll expenditures.

Cost Reports and Production

The cost department necessarily has a very intimate relation to the factory administration, for while the man in charge of manufacturing directs labor and through foremen assigns the employees to their respective tasks, it is the duty of the cost department to keep track of the expenses incurred and results secured, and report them promptly to the executive department of the organization.

In most cases it is tremendously important that the results should be reported promptly to the factory superintendent, to the foremen, and in many instances to the workmen themselves, if the efficiency of the factory is to be kept up to a satisfactory standard. The superintendent will not often concern himself with the cost of individual jobs from day to day; but where labor is handled in gangs, or where it includes all the men in a department which has a daily report of production by tonnage, or for operations on a large scale, it is of the utmost importance that the factory executives should know immediately what results are being secured, and at what cost per unit for the various kinds of product.

Some surprising results have been obtained from the use of records which give the management prompt and reliable information as to what each workman in the factory is doing. When records were introduced into one factory which had been going along at a fairly even pace, and the men realized that the management was getting information as to what each individual man was doing, the performances immediately began to improve, simply from the moral effect of having the records. Without any material change in the selling price or volume of sales the company made

a greater net profit in the first two months when the cost system was running than in the previous ten months under the old plan, which did not give specific and up-to-date information. This was due to the fact that the company was selling with a very small margin of profit and any decrease in manufacturing costs materially increased the *net* profit.

In the repair department of a large plant, by keeping a record of the cost of individual jobs in comparison with standard tasks set before each job was started, a large decrease was made in the repair gang and in the unit cost of all repair work done. In this case two important factors were working together to improve the efficiency, one the task and bonus plan, and the other the prompt and reliable information as to what was going on. There is all the difference in the world between knowing today what the repair costs were yesterday or last week, and getting information of this kind that is a month or more old.

It is of great importance to have continuous current records in the manufacturing departments, not only from the standpoint of efficiency, but also to give reliable costs. Costs which are based on test runs are nearly always lower than the average, as the employees are considerably more ef-

ficient when they are under observation during tests than in their general work, when they know that no definite records are being made of their performance which will be figured out as part of the costs, and if high, will be brought to the attention of the management. Costs, therefore, which are based on test runs, and not "tied in," cannot be relied upon.

Cost Accounting and Scientific Management

Before leaving the subject of the relations between the cost department and the payroll, it should be pointed out how intimate the relation necessarily is between the production department and the cost department under any plan of standard tasks with bonus, which is typical of modern or scientific management.

The fundamental idea in such operations is to have a consistently high rate of production, a satisfactory compensation to the workers and minimum cost to the management. It has been found by experience that plans of this sort depend on detailed calculations of standard tasks and costs from day to day, and in some cases almost from hour to hour. The planning department in a highly organized factory directs production, but the cost department must coöperate with it to

measure results and to establish effective working relations between the factory organization, the cash book of the owners, and the pay envelopes of the operatives.

Under the influence of the new science of management, there has been a constant study in the last few years of manufacturing methods, operating standards, cutting speeds, etc., resulting many times in such marked increases of production that the management may be sure that an improvement has been made, even if it is not known exactly how much saving has been effected.

It has been clearly established, however, that the cheapening of manufacturing operations which is brought about by a better operating practice is frequently secured at a considerably increased cost for office force, planning departments, helpers, supervision and other indirect labor, sometimes wrongly called non-productive. The practical problem for the manufacturer is to compare the lessened direct cost for labor and equipment with the increased cost for the other factors. This he can do only when he has an adequate cost accounting practice.

The weak point in scientific management, as often practiced, is in setting up records entirely disconnected with the general books, and thus fail-

ing to measure the actual performance in comparison with the standards set in a way that will prove with the net profits shown by an inventory. Scientific management is never complete unless there is developed at the same time an accounting practice which shall adequately reflect for the management the *net* results of all industrial endeavor.

Burden Costs

The function of cost accounting in respect to burden is to determine as accurately as possible the burden belonging to the various manufacturing operations, or to the respective departments of a business, and then to record the burden element in the cost of the product as it passes through the various departments and adds to its value by absorbing its proportion of burden from its use of the manufacturing plant and equipment. Many cost systems which have fairly good records of material and labor fail entirely in their purpose because they deal so inadequately with the subject of burden. Important elements of indirect costs are thrown together in a "general expense" account, concealing the leaks and wastes that reduce efficiency and curtail profits.

Many manufacturers have no doubt been satisfied to handle burden in vague and general terms

because they have not known of any better way to dispose of it. As shown in the preceding chapters, if the problems are approached in a scientific way and with an open mind, the overhead expenses can be first analyzed and then distributed to give burden costs as reliable as the labor and material costs.

Burden on Unused Equipment

Burden rates scientifically determined enable the cost department to obtain reliable costs of the work done, and also make possible an accurate measure of the loss due to slack production or interrupted operation, in each department and in the factory as a whole.

When the board of directors is gathered at the end of the year, or once in six months, to learn about the results of the period under review, they do not often consider such detailed matters as the cost of individual products. On the other hand, they are always interested in any explanation which the manager has to make about losses that are due to curtailment of manufacturing operations.

The manager and the directors at such times would value more than anything else, a clear statement showing how much their company had lost

on this account, especially if the details of the statement could be readily understood and proved by analysis of the operating conditions. The big problems (in regard to manufacturing) which the directors have to settle, are to make efficient use of plant and equipment, especially if they are asked to decide on new buildings or equipment to meet a probable volume of business.

To illustrate the value of a record of equipment used in each department, let us consider a lathe department of a machine shop in which a press of work seemingly showed that more lathes were needed. By examining the records the management saw that for a long time many of them had stood idle. A little overtime work took care of the emergency, and the purchase of the additional machines was found to be unnecessary. The cost department thus makes possible the scientific balancing of factory equipment, which is an essential feature of efficient and economical shop management.

From the manager's point of view, the significant fact is that the burden is not appreciably less when the operating schedule of the plant is reduced. It is true that power charges may be slightly less, but the fixed charges for building space, interest, insurance, taxes, depreciation, and

in some circumstances for repairs also, are no less when the machines are idle.

Effect on Sales Policy

If the distinction is maintained in the cost records between losses or gains on goods made and sold, and losses due to restricted output, the management will consider sales policies in a much more certain way than is possible when the facts are obscured in the haze of average costs, calculated on varying volumes of product. In respect to burden it is frequently true that costs figured as averages vary beyond all hope of comparison as the volume of output goes up or down.

When a cost accounting practice is maintained that distinguishes carefully between prime costs for materials and labor (which vary almost directly with the volume) and overhead charges or burden, the managers can see exactly in times of slack production at what price they can offer a new line to get something to carry the burden of the factory, in addition to the direct cost of labor and material.¹ This, it must be admitted, is to

¹ If the pressure for business is severe enough, there will be an immediate financial advantage in taking orders at any price which will return the prime labor and material cost, that is, pay the workmen who must be hired, and buy the material that must be used on the new order, or get a fair return for

some extent a matter of policy, for it may be better to hold a price and restrict output, rather than break the market by quoting prices that will give temporarily a little additional business.

Whatever the effect on sales policy, good cost accounting, including correct burden distribution, is a matter of enduring importance from the point of view of manufacturing. Changes in volume may completely obscure gains or losses in efficiency, and render comparative costs of similar product impossible from season to season, solely because of the variations in the amount of business done. Reliable costs, comparable under all conditions, are not to be secured unless the burden charged to

available raw material that is already on hand. In a calculation of this kind the management will ignore burden charges that are actually fixed, or practically so, because of the intention of keeping the organization together. Cases are frequently reported in the newspapers during a period of business depression of orders taken at an actual loss, either for the sake of finding work for the otherwise idle employees, or, as is frequently said, "to keep the organization together." If these reports are to be taken literally they mean that as to immediate financial return the manufacturer would be better off to lose the order rather than take it. It may very well be that manufacturers especially well disposed toward their employees, or far-sighted in reference to the value of keeping an organization together, may actually have gone to such limits in some instances, considering it good business to do so at the time, and being confirmed in that opinion, it is to be hoped, by the subsequent events.

production is only that pertaining to the equipment that is actually at work.

Cost Accounting and Manufacturing Policy

The executives are also interested in scientific burden distribution when they determine large questions of policy in buying, manufacturing and selling; whether, for example, to manufacture, or to buy and assemble. There may be some work, such as box making or printing, which is in competition with outside companies, and where true comparisons can be made only after the proper proportion of burden has been considered.

The question may also arise whether to buy or sell the main product partially completed. For instance, a factory making shoe findings may buy leather in sides, blocked or cut, and may sell at several stages in the process of manufacture, depending upon the market, the condition of the factory, and the cost of the product up to any given point. A scientific distribution of burden is essential in determining the point where the greatest profit can be made.

In solving such problems the management should look to the cost department for the information on which to base their decisions. In any large concern the cost department must be

the eyes and ears of the executives, as it is impossible for them to know by personal observation what is going on in all the departments at all times.

What personal observations they make are liable to lead to incorrect conclusions, without reliable information regarding the average performance of employees. For example, in a large plant where the superintendent was accustomed to make daily rounds of all the departments, it was the custom of the workmen in one of the stockrooms to have a man on guard at each door who would, on the approach of the superintendent or foreman, signal to the other employees by dropping a casting or giving a low whistle. The result was that the department had a good reputation for hustling. As a matter of fact it was exceedingly inefficient, as was proved later by a change in management and the introduction of records and a piece work system for handling the stock, which reduced the force by 15 men.

The function of the cost department is to gather information from which the management can outline its policies, and then record to what extent and how quickly these policies are being carried out. Proper reports should relieve the manager of details and at the same time so visualize conditions

that his personal efforts may be applied wherever and whenever necessary. Better management, more profitable management, is not to be attained through some miraculous remedy to be applied as a fertilizer to make the business grow. It is almost solely a matter of studying the business critically and then acting intelligently upon the information secured. The information for such study will be at hand in the cost department.

Since the cost department is both the eyes and ears of the management, it is especially important that both their sight and hearing be acute. Not only should the records be well designed to fit the peculiar needs of the business, but the man in charge of the cost department should be capable, not only of keeping the records in balance and seeing that they are arithmetically correct, but also of reading the results and presenting *live* facts to each man interested, whether he is a mechanic operating a machine tool, or is a member of the board of directors. The head of the cost department should be so recognized in the organization that he may be in touch with all important matters, and thus be of the greatest assistance to the executive officers. It might almost be said that it is impossible to get too good a man to have charge of the cost department.

Checking Salesmen's Estimates

One of the minor results of a good cost system and yet a very useful one in some industries is the check which the management secures on salesmen's estimates.

On construction work bids are made and contracts taken which remain to be proved by experience, either profitable or unprofitable for the contractor, and sometimes the margins of loss or gain are very large. If the contractor in such cases is to reap any benefit from his experience it will be by having an analysis made of the cost of the work as it is actually done, to compare section by section, or kind by kind, with the estimate on which the bid was made and the contract taken. This is equally true of plants manufacturing on order special machinery or any other product to meet the special requirements of their customers.

In certain kinds of industry salesmen are constantly taking small orders at agreed upon prices which are based on schedules or estimates in the salesmen's price books. Specially ruled stationery, either loose-leaf, bound book, or card, provides a familiar illustration. Different salesmen will frequently serve widely different lines of industry, so that their orders, although manufactured in the same shop, will be quite distinct in

character. To a manufacturer who is selling goods in this way, it is a great advantage to have cost records so built up that he can check the standards which have been set for his salesmen as the basis for quoting prices, and can check the use that the salesmen make of these schedules.

It is hardly necessary to say that if an article is made or work undertaken that is likely to be repeated, it is of special interest to the vendor to keep such a record and control of the cost as will enable him to consider similar work intelligently in the future.

Cost Accounting in Different Industries

One of the most obvious facts connected with cost accounting is the widely varying demand that different kinds of industry make on a cost accountant.

In a mill devoted exclusively to the manufacture of grain bags, with no change throughout the year in the size or grade, the chief variable element in the cost calculations is that of raw material, which in turn depends on the cotton market. The cost system in this mill consists solely of a subdivision of the expense accounts, following more or less closely the successive steps in manufacturing the absolutely uniform product. The chief function

of a cost department under such circumstances is to record correctly the subdivisions of the payroll, and to report the unit costs from week to week or month to month.

A textile mill making fancy worsteds, on the contrary, has one of the most complex cost problems. This is due to the great variety of product, frequently sold on such a narrow margin of profit that small and exact distinctions must be made between the costs of different fabrics—and for each, labor, material and burden separately.

Tannery cost accounting is difficult chiefly because hides and partly finished leather are relatively unknown quantities, and costs can be apportioned only on the information secured when the finished leather is graded and ready to ship. In tanneries, as in many other continuous process industries, "process rates," combining labor, supplies and burden, are the only practical means of getting reliable costs at a reasonable expense of clerical labor.

A machine shop, doing jobbing work, must keep an individual cost of each job. Reports must come from the shop showing the material used, the work done, and the time consumed. The cost department will accumulate the direct charges and add the burden (which includes all the indirect

labor) so that they will have a reliable total cost for the completed job.

Another factory makes only suit-cases of rattan, cane and woven grass, using a little metal for fastenings and trimmings, and leather in small pieces for the corners and bindings. A few of the suit-cases have iron frames and substantial straps in addition, but all of this product can be finished within such a few hours after it is started that the cost accounting consists solely of scheduling the various steps of manufacturing, taking an inventory at the beginning of a production period and another inventory at the end to check up the scheduled cost of the goods manufactured in the interval.

This principle of scheduled costs is capable of wide application in such industries as the making of shoes and clothing, and sometimes can be applied successfully to manufacturing operations so minute and complex in their relation to each other that they cannot be satisfactorily or economically recorded in any other way. (See Chapter XVIII.)

Cost accounting in a piano factory is largely a question of scheduling material on master lists and keeping an exact control of production. If the labor is largely piece work, as it is in many factories, both labor and burden may be scheduled

almost as conveniently as material, and the scheduled costs proved at frequent intervals by accounts controlling stores and work-in-process.

These examples show how the ingenuity of an experienced cost accountant is sometimes taxed, like the resources of a mechanical engineer, to find new ways to apply well-known principles so that the operations may be accurately recorded and measured.

Cost accounting at its highest development is a science and an art worthy to rank beside some of the older and better known professions. It depends not only on mathematics and economics, but sometimes to an important extent on physics and chemistry. It deals constantly with great problems of human nature; it is one of the most interesting vocations for an energetic man; and it has a large reward for a man interested in adding to the sum total of human knowledge.

APPENDIX

There has been so much discussion prior to the publication of this volume as to the significance of interest on investment as a part of cost, that it seemed to the author that it would be a useful contribution to the literature of accounting theory to make a systematic examination of the writings of the well known modern economists. The intention at first was to cite a few representative references in support of the general statement made in the introductory paragraph of Chapter VII. This was open to the objection that it might be said that the quotations had been selected to support the author's view, and that an equal number might be found in support of the opposite opinion. It not only seemed desirable to anticipate any such criticism, but also to exhibit to all persons interested the overwhelming theoretical testimony in support of what is practically a very desirable course in industrial accounting.

The following pages are not offered as exhausting the subject, but the remarkable concurrence of opinions seems to indicate that the economists who have given any attention to the matter have arrived at the same conclusion, namely, that interest on investment is properly a charge to cost. Some of them, it will be noticed, use that exact wording.

It is perhaps significant to the reader to add that the references were searched for by a trained economist whom the author had never met personally, and who, so far as the author knows, had no idea as to his opinion

in regard to the matter, or the use that was to be made of the references which were found.

These citations in the appendix have been arranged as nearly as possible in chronological order. The earlier quotations are historically interesting; the later ones are far more complete, and more significant to present-day business men and accountants.

As many of the passages quoted contained italics, which for the purposes of accurate quotation ought to be retained, it has seemed best uniformly to use black face type to indicate the words and phrases that the present author wishes to emphasize for the reader's attention.

An excellent historical summary of the views of various writers on the distinction between interest and profits is contained in Palgrave's "Dictionary of Political Economy," Vol. III, London, 1910 (1st ed., 1899), pp. 222, 223. According to that compiler, Adam Smith ("Wealth of Nations," Bk. I, Chap. VI) distinguished between the earnings of a capitalist and a non-capitalist performing similar work; Malthus ("Definitions," 1827) divides gross profit into interest and "the profits of industry, skill and enterprise"; M'Culloch ("Principles," 2nd ed.) makes the same division; J. S. Mill ("Unsettled Questions," pp. 107-109, and "Principles," Bk. II, Chap. XV, Sec. 1) "treats profits as including the whole of the gains of the capitalist, whether due to the mere possession of capital, or to that and the performance of labor and the undergoing of risk. Fawcett (*Manual*, Bk. II, Ch. V), Jevons (*Primer*, p. 52) and Marshall ("Principles," Vol. I, 1st ed., p. 142, 3rd ed., p. 156) adopt the same course. Some writers, however, e.g., Rogers (*Manual*, Ch. XI), B. Price ("Practical Political Economy," Ch. V), C. L. Shadwell (*System*, p. 158), fol-

low Adam Smith's plan of regarding as profits proper only that portion of the capitalist's gain which he may be supposed to obtain without personal labor and if fully insured against risk; while F. A. Walker, on the other hand, desires to apply the term 'profits' only to the other portion of the entrepreneur's gain, namely, that which is over **after deducting interest** on all the capital he employs, whether it belongs to himself or to another person ("Political Economy," 1885, p. 247). In practical life the term 'profits' is used in all three senses with almost equal frequency."

W. STANLEY JEVONS: "The Theory of Political Economy," London, 1871, 4th ed., 1911, Chap. VIII: "If we resolve profit into wages of superintendence, insurance against risk, and interest [Mill's and Adam Smith's division], the first part is really wages itself; the second equalizes the result in different employments; and the interest is, I believe, determined as stated in the last chapter." (p. 270.) . . . "Competition will proceed until the point is reached at **which only the market rate of interest is obtained for the capital invested.**" (p. 271.) (Chapter VII is devoted to the long-run rate of interest.)

J. B. CLARK: "The Distribution of Wealth," N. Y., 1899, ed. of 1902, Chap. I, pp. 2, 3: "The function of this natural law is to separate the gross earnings of society into three generic shares that are unlike in kind. It causes the whole annual gains of society to distribute themselves into three great sums—general wages, **general interest** and aggregate profits. [The rent of land is to be regarded—for reasons that will appear later—as merged with interest.] These are, respectively, the earnings of labor, the **earnings of capital** and the gains from a certain coördinating process that is

performed by the employers of labor and users of capital. This purely coördinating work we shall call the entrepreneur's function, the rewards for it we shall call profits. The function in itself includes no 'working' and no owning of capital: it consists entirely in the establishing and maintaining of efficient relations between the agents of production."

Again in Chapter VIII, p. 111 : "Normal prices . . . afford wages for all the labor that is involved in producing the goods, including the labor of superintending the mills, managing the finances, keeping the accounts, collecting the debts and doing all the work of directing the policy of the business. They afford, also, interest on all the capital that is used in the business, whether it is owned by the entrepreneur or borrowed from some one else. . . . Wherever there is an entrepreneur's net profit, some article is, for the time being, selling for more than this normal price. The tendency of competition is to annihilate the profit; and that is the same thing as bringing actual prices to what, in accepted economic theory as well as in common experience, is their 'natural' level."

THOMAS N. CARVER: "The Distribution of Wealth," N. Y., 1904, Chapter VII, "Profits," p. 259: "Though broadly defined as the income of the business man who receives neither stipulated wages, rent, nor interest, the meaning of the term 'profits' has been narrowed down by the enlargement of the definitions of the three other shares. If wages are the earnings of all labor, they must, of course, include the earnings of the independent worker, whether he runs a small shop where he works alone, or a large establishment where hundreds are working for stipulated wages under him. Similarly, if rent is the earnings of land, it must include the earn-

ings of the business man's own land, and for the same reason interest must include the earnings of his own capital."

Again, p. 285: "In view of all that has been said, we may conclude that profits include only what is left after the other shares are paid. This does not mean that profits are a residual share in the sense that the others are determined independently by law^s which affect them each alone, leaving profits as a share which can be determined by no law except that of subtraction. There is no such thing as a residual share in that sense, for any change which affects one share will affect them all in one way or another. They all mutually help to determine one another. But in a very concrete sense the profits of a given business man are what he has left after paying all his expenses and allowing himself wages for his own labor; such wages as he could command in the market if he were to offer to work for some one else, besides interest on his own capital and rent on his own land; such interest and rent as these factors would bring on the market."

FREDERICK B. HAWLEY: "Enterprise and the Productive Process," N. Y., 1907, speaks of the profit of an undertaking, "or the residue of the product after the claims of land, capital, and labor (furnished by others or by the undertaker himself) are satisfied, is not the reward of management or coördination, but of the risks and responsibilities to which the undertaker (usually spoken of as the entrepreneur, but whom I prefer to designate as the enterpriser) subjects himself."

CHARLES J. BULLOCK: "Introduction to the Study of Economics," 3rd ed., 1908, p. 462: "The necessary profits received by all employers, even the marginal ones, are composed of two elements. First, they include inter-

est on invested capital, computed at the current market rates." . . . "The second element in necessary profits is the remuneration for the efforts and trouble that employers incur in the management of productive enterprises."

H. J. DAVENPORT: "Value and Distribution," Chicago, 1908; Chapter VIII, "Profit Defined: Profit and Risk as Related to Cost," p. 97: "It has been the writer's preference to use the term profit . . . as denoting . . . the residual compensation falling to independent business activity after such apportionment as is possible has been made for rent, interest, wages, and other outlays."

J. A. HOBSON: "The Industrial System," London, 1909, p. 9, ¶ 9: "Profit is the portion of the product left to the undertaker or controller of a business after the expenses of the factors of land, capital, and labor have been defrayed."

ALFRED MARSHALL: "Principle of Economics," 6th ed., London, 1910, Bk. II, Chapter IV, "Income. Capital." Sec. 2, p. 73, after provisionally defining interest: "And, if a man employs in business a capital stock of goods of various kinds which are estimated as worth £10,000 in all; then £400 a year may be said to represent interest at the rate of four per cent on that capital, on the supposition that the aggregate money value of the things which constitute it has remained unchanged. He would not, however, be willing to continue the business unless he expected his total net gains from it to exceed interest on his capital at the current rate. These gains are called profits."

Again in Bk. V, Chapter IV, "The Investment and Distribution of Resources," (Sec. 5,) p. 359: "Some technical terms relating to costs may be considered here.

When investing his capital in providing the means of carrying on an undertaking, the business man looks to being recouped by the price obtained for its various products; and he expects to be able under normal conditions to charge for each of them a sufficient price; that is, one which will not only cover the *special, direct, or prime cost*, but also bear its proper share of the general expenses of the business; and these we may call its *supplementary cost*. These two elements together make its *total cost*."

"There are great variations in the usage of the term Prime cost in business. But it is taken here in a narrow sense. Supplementary costs are taken to include **standing charges on account of the durable plant in which much of the capital of the business has been invested**, and also the salaries of the upper employees: for the charges to which the business is put on account of their salaries cannot generally be adapted quickly to changes in the amount of work there is for them to do. There remains nothing but the (money) cost of the raw material used in making the commodity and the wages of that part of the labor spent on it which is paid by the hour or the piece and the extra wear-and-tear of plant. . . .

Supplementary costs must generally be covered by the selling price to some considerable extent in the short run. And they must be completely covered by it in the long run; for, if they are not, production will be checked."

(Again in Bk. IV, Chapter XII, "Business Management," Sec. 12, p. 313: "Finally, we may regard this supply price of business ability in command of capital as composed of three elements. **The first is the supply price of capital**; the second is the supply price of business ability and energy; and the third is the supply

price of that organization by which the appropriate business ability and the requisite capital are brought together. We have called **the price of the first of these three elements interest**; we may call the price of the second taken by itself *net earnings of management*, and that of the second and third, taken together, *gross earnings of management*.”¹

IRVING FISHER: “Elementary Principles of Economics,” N. Y., 1913, Chapter XXIV, p. 434: “The income of a community may therefore be classified into rent and wages, and each of these subdivided into explicit and implicit classes. We thus have four great branches of income—explicit rent, explicit wages, implicit rent (or capitalists’ profits), and implicit wages (or enterprisers’ profits).

“Moreover, since the income included under rent (explicit or implicit) may be measured with reference to the *value* of the capital producing this income, it may also, as we have seen, be regarded as interest (explicit or implicit).

“Practically, therefore, we may divide the income of a community into six main parts simply by separating out from rent, whether explicit or implicit, the part which is reckoned in terms of the value of capital, i. e., that part which is *interest*, whether explicit or implicit. While it is true that all rent *may* be translated into inter-

¹As Alfred Marshall is one of the foremost modern British economists, if not, indeed, the most eminent of them all, the British accountants who differ from the present author should regard these passages as conclusive authority as to the economic theory involved in the discussion of interest on investment as a charge to cost.

They are also significant with reference to the very practical problem of determining selling prices, with reference to cost especially when sales are proposed at less than complete cost. See footnote, page 288.—Author.

est, only part of rent is, in the actual world of business, so expressed. We therefore find in the modern world six great branches of income considered in reference to the source from which it comes. These are commonly called wages and enterprisers' profits, rent and capitalists' profits, interest and dividends. The first pair are measured per man, the next pair per acre or other physical unit of capital, and the last pair as a percentage of capital-value.¹ [The classification of income here given corresponds closely to that of business men, but differs somewhat from that in most other textbooks. . . .]

"The peculiarity of profits lies in the element of chance. Stipulated wages are supposedly certain, while profits are, by the nature of the case, uncertain." (p. 455.) He says further that such risk is, on the whole, distasteful, and has to be compensated.

"Hitherto we have spoken separately of the capitalist who is a profit-taker and of the employer who is a profit-taker, but, as has been indicated, often one and the same person is both capitalist and enterpriser. . . . It thus usually happens that the profits which a man receives cannot be easily classified into **profits from his capital and profits from his own exertions.** Generally his profits are the joint product of both his labor and his capital." (p. 458.)²

¹ This stated relation between Interest and Rent is of special significance in view of Mr. Dickinson's contention that they should be treated alike, and both excluded from costs. Prof. Fisher and Mr. Dickinson seem to agree as to premises, but to differ entirely as to the conclusion. See page 114.—Author.

² This passage is the only one the present author has been able to find among the economists examined that seems to throw any doubt on the views that interest and profits are logically different. Even here Professor Fisher says only that the classification, presumably desirable, is not easily secured. On this point, as a matter of fact, he is mistaken.—Author.

HENRY R. SEAGER: "Principles of Economics," New York, 1913, Chap. XI, "Production and Distribution," p. 173: "The wages-of-management of the enterpriser is prospective. Normally it must remain after the other shares have been paid out of the money income, but **these other shares must be paid first.** In a shoe factory, or any other typical business, these other shares—all of them expenses of production in addition to the replacement fund which must be provided for as a matter of course,—are: (1) rent for the use of land and natural powers; (2) wages to workers of different grades; (3) **interest for the use of capital;** (4) taxes. . . .

"The item of interest for the use of capital is calculated at a certain rate per cent per annum for the capital employed. Thus if a business ties up on the average throughout the year capital goods worth \$10,000 and the current rate of interest is five per cent, \$500 should be charged as expense for interest. This item should appear if, in the shoe factory considered, capital belonging to the enterpriser himself rather than borrowed capital were used. When borrowed capital is used, the expense for interest is an actual outlay; when the enterpriser's own capital, it is a virtual outlay, since using the capital in the business prevents loaning it at the current rate to some other enterpriser."

EDWIN R. A. SELIGMAN: "Principles of Economics," 6th ed., New York, 1914, Chap. XXIII, "Profits," p. 354, (Sec. 151): "Ordinary Profits:—Profits are the income from business enterprise. They are not necessarily limited to capital. An employment agency or an Italian *padrone* may make profits from directing labor into the right channel. A real estate operator may make profits out of selling land. **Profits are a result of business enterprise,** and the entrepreneur may deal in labor, in

land, in capital or in all three. It is hence inexact to speak only of the profits of capital. . . .

"Profits are always a surplus. They are the difference between the **cost of production or acquisition and the selling price**. They form a differential, however, in a second sense. Profits are the surplus of the intramarginal over the marginal producer. At any given time, under competitive conditions, market price is the same (p. 235), but cost varies. The expenses of production are manifold, but may ordinarily be classified into cost of raw material, wages, rent, **interest on the capital borrowed or invested**, taxes and miscellaneous outlays like insurance, advertisements and transportation expenses. . . ."

"It is evident that in the long run profits could not exist in a state of normal equilibrium. (p. 355.) . . . The gross earnings or gross profits would indeed **include interest on capital invested**; for if the business man did not earn interest on his capital, he would go out of business and loan his capital at the normal rate to some one else. . . ."

(P. 357.) "The older writers confused interest with profit. Interest is the return from the fund of capital; profits are the return from the conduct of business enterprise, irrespective of whether the enterprise deals with capital or labor or both. **Interest is a part of cost**; profit is a surplus above cost. Interest, as we shall see, has a normal rate; profits may have an average rate but no normal rate. The marginal producer earns no profits; the intramarginal producers make profits which vary with the discrepancy of their cost from the market price."

In Chapter XXV, "Interest," p. 394, Sec. 165, he says: "Interest is commuted rent, or the calculation

form of rent. Just as a business man must deduct the rent or royalty of some patented machine used by him before computing his profits, so, if he buys the machine outright, he must deduct the interest on the capital invested in the machine. Whether he uses his own capital or borrows it is immaterial; in the latter case it is loan or contract interest, in the former it is natural or economic interest. The distinction is the same as that which we have learned between contract and economic rent. Whether he pays the interest to another in virtue of some contract or keeps it makes no difference."

• F. W. TAUSSIG: "Principles of Economics," Revised Edition of 1915, Chap. 50, "Business Profits" (continued), p. 179: "We have tacitly assumed that so much only of a business man's income is to be regarded as profits as is in excess of interest on the capital which he manages. If he happens to borrow his capital, this is clearly true. He then pays interest to another, and only his net earnings over and above interest go to him as business profits. Usually his capital is partly borrowed and partly his own (or that of relatives or friends, put at his disposal from other than cold-blooded pecuniary motives). On that part which is his own, he must indeed remember that interest could be got at current rates without the risk and labor of actual management; and therefore he must reasonably reckon only the excess over such interest as his earnings of management or business profits."

J. LAURENCE LAUGHLIN: "The Elements of Political Economy," Revised Edition of 1915, Chap. XIX, "Interest," p. 202: "In many treatises on political economy, and in the language of business men, the word 'profits' is employed to include three different payments, which should be kept separate. It is made to cover in-

terest, insurance, and wages of superintendence. **Interest** is, however, the payment made **solely for the use of capital**, and wages of superintendence form the reward paid for the exertions and skill of the manager."

Chap. XXII, "The Industrial Manager," p. 248: ". . . As usually viewed, this large payment [to the industrial manager] is connected with the ownership of capital, and it is said that a manufacturer is getting enormous 'profits.' This way of looking at it obscures the real truth. For the **ownership of capital, a manager can get no more than any investor of equal judgment, and this payment is interest.**"

P. 249: "It is necessary to separate the idea of 'profits' into its parts, especially as the amount of the two parts is governed by different principles: (1) the payment **for capital, according to the laws governing interest**, and (2) the payment for managing ability, according to the laws governing the wages of skilled labor."

FRANK A. FETTER: "Economic Principles," New York, 1915, says: the term profit, or profits, means broadly the **residual share to the person or group of persons who assumes the financial risk** of the business, after paying off the claims of every one else for any uses or services rendered. But since there are so many variations in the proportion of property owned or leased, or the amount of salaried managerial service, "profit in any such general sense is not a scientific term for the purpose of studying the forms of income; **it has not even a precise practical significance**" (p. 144).

Again (p. 345): "Investment profit usually is subjected to a comparison which divides it into two elements. We have seen (Chapter 26, section 4) that it is of the very essence of the active capital function that it takes the

financial risk of the outcome. When therefore at the end of the year (or income period) it appears that a certain profit has resulted (say \$1,000), this is compared with the capital invested (say \$10,000) and expressed as a percentage on the investment (thus 10 per cent). Now this in turn is compared with the rate of interest common on the safest loans (say 4 per cent) and the remainder is the amount (or rate) by which this active-capitalist investment exceeds the current rate of passive capital investments. . . . There is a dual character in investment profit; it is a capital-income and a labor-income, combined. The distinctive feature of investment profit, which fastens our attention, is precisely this excess (or deficit) of income in active-capital as compared with the normal prevailing rate of time-price, which can be secured by the most conservative passive investor. It is the hope of an income more than ordinary interest that is the inducement to active capitalists to assume the risk. We may call the amount realized more or less than the imputed yield of passive investment, pure investment profit, attributable to the exercise of *pure* investment function. The amount may be expressed as a rate on the investment. This is the utmost point that has been attained in the analysis of the complex elements of 'profits' as popularly used."

ADDENDUM

Just before this volume was ready for printing, the author submitted Chapter VII to Mr. Geo. O. May of the firm of Price, Waterhouse & Company, whose views the author had occasion to criticise on pages 118 to 122. Mr. May writes, "I have read the proof of your chapter dealing with interest in costs and have no exception to take to the manner in which my article is dealt with therein."

In reference to the comments on Mr. Dickinson's article, Mr. May writes: "So far as it dealt with rent you hardly do justice to him, in so far as you deal with the question of expense items included in rent in addition to interest. Mr. Dickinson's article makes it perfectly clear in speaking of rent that he is excluding all items other than the interest or return element (see particularly the footnote on page 95 of the *Journal of Accountancy* for August, 1913)."

The footnote to which Mr. May refers reads as follows: "It may be well to mention here that rent may include something more than interest, in which case a part thereof may properly be included in cost, and, further, that in the case of office rents, convenience and the relative unimportance of the amounts may sometimes justify their inclusion in the cost of production or selling, usually the latter."

The reader who will refer to Mr. Dickinson's article

will see that although he speaks of rent, or rentals, as merely a kind of profit, and on that reasoning not chargeable into the cost of manufacturing, the footnote referred to does make some recognition of the fact that certain expenses of doing business frequently comprised in the term *rent*, such as insurance and taxes on the buildings or rented equipment, and also depreciation and repairs, are inevitable items in a charge to cost because of their actual and unavoidable character, which finds expression in the ultimate disbursement from the cash drawer.

The footnote refers to a paragraph in Mr. Dickinson's article in which he speaks of the landlord as a partner in the business. It seems to the present author unsound in theory and wholly impracticable to regard a landlord as a partner in a business in respect to the capital he has invested, but not in respect to the taxes and insurance that he pays, his outlay for repairs, or his loss through depreciation. Practical common sense seems to say that the landlord is a creditor rather than a partner or "contributor" (Mr. Dickinson's term) to the enterprise, so that what is paid to the landlord is clearly a cost.

In the letter from Mr. May quoted above, he says: "When you state that an investment in additional machinery which does not earn interest is unprofitable, the natural inference drawn by the ordinary reader is that an investment which does earn interest is worth while, and this is to my mind the great fallacy which the school of thought you have presented tends to perpetuate." It is a pleasure to have Mr. May join issue with the author as clearly as he does in that sentence, for the view there expressed is, in the author's opinion,

quite as important and worthy of consideration as anything which can be brought forward in support of the view which Mr. May holds.

Whether an investment which earns no more than ordinary interest is worth while depends on the opportunities which the investor has to secure a higher rate, and the risk he is willing to take for the chance of the higher rate. As both Mr. Dickinson and Mr. May have pointed out, there are a great many business enterprises which return to their owners rates of dividend far in excess of any conventional bond interest, and investors who are skillful in using their capital on enterprises of this kind will naturally scorn a simple 5 per cent.

The fact is, however, that thousands of enterprises are launched which do not in the long run pay their owners even 5 per cent, and the whole trend of thought in regard to industrial investments, and more particularly in regard to the sales prices of goods, is obscured, in the author's opinion, because the investors frequently do not realize for a long time that their investment is not bringing them even a conventional return on their money (especially if the undertaking does not immediately make losses big enough to threaten its continuance). As the author has endeavored to point out on page 122, prospective investors ought to consider **how much better than the conventional investor's rate they can secure by risking their money in an industrial enterprise.** This reasoning will usually apply in the same way in regard to an additional investment in a business already established. The question must be asked, "Will this new equipment pay?" and it will be generally conceded that the new equipment will pay if

it enables the proprietors to make their product at a lower cost after they have reckoned interest on the additional investment required.

Mr. May would, of course, assent to the statement that many an additional investment is made without the expectation of getting more than a fair interest rate of return, or in other words when the cost of production would not be diminished appreciably if interest on the new investment were reckoned in that cost, because the owners or executives feel that the additional purchases will insure them against an interruption of their manufacturing operations, or any other inconvenience that might be prevented by providing themselves more adequately with plant, equipment, or merchandise inventories.

In considering the significance of interest on investment as an element in cost, the reader must bear in mind that the object of making such a charge is to understand correctly **what the product costs**. One does not have to argue beyond that as to the way in which these costs shall be used in order to establish that point, although it is the author's opinion that the more carefully one considers the varied uses of accurate costs, the more certainly does he arrive at the conclusion that interest on investment should be reckoned as a factor.

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